SDCS One-to-One Computing: Survey of Research

Title II, Part D of the federal *No Child Left Behind* Act (NCLB) established a primary federal goal for technology in education: To improve student academic achievement through the use of technology. The goal of this component of NCLB is to "Assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability."

While preparing the National Educational Technology Plan (2004), the U.S. Department of Education obtained students' perspectives through an online survey of 210,000 K-12 students (NetDay, 2003). The National Educational Technology Plan identified several major themes from the students' comments (U.S. Department of Education, 2004, pp. 19-21):

- Today's students are very technology-savvy, feel strongly about the positive value of technology and rely upon technology as an essential and preferred component of every aspect of their lives.

- Students are not just using technology differently today but are approaching their lives and their daily activities differently because of the technology.

- As students get older, their use of technology becomes more sophisticated, but, comparatively, the younger students are on a fast track to becoming greater technology users and advocates.

- Students would like to have more opportunities to use computers for online access to information, school assignments, and tutoring. Several students quoted recommended having one computer per student, possibly a laptop that they could take home, to give them individual access to technology in school and at home.

Research and evaluation shows that technology can enable the development of critical thinking skills when students use technology presentation and communication tools to present, publish, and share results of projects (Cradler et al, 2002). When students use the Internet to research topics, share information, and complete a final project within the context of a semi-structured lesson, they become independent, critical thinkers (Coley, Cradler & Engel, 1997). When students learn to use applications used in the world of work, such as word processors, spreadsheets, computer-aided drawing, website development programs and the Internet, they acquire some of the prerequisite skills for workforce preparedness (Cradler et. al, 2002). The National Education Technology Plan (2004) concluded that "Technology ignites opportunities for learning, engages today's students as active learners and participants in decision-making on their own educational futures and prepares our nation for the demands of a global society in the 21st century" (2004, p.46).

SDCS has a state-approved Educational Technology Strategic Plan that provides a roadmap for the district to improve student academic achievement through the use of technology. The goals of the SDCS Educational Technology Strategic Plan include integrating technology into instruction, making classroom management more efficient, enhancing communication with parents and the community, preparing teachers to use technology as an integral tool to enhance and support their teaching, and providing the needed technology infrastructure. One objective of the plan is to provide all students with adequate access to one-to-one computing resources to meet their learning needs.

In their efforts to prepare young people to meet the increasing skill requirements of the 21st century (see Greenspan, 2004; U.S. Department of Education, 2004; Partnership for 21st Century Skills, 2002), a number of states and school districts have implemented pilot one-to-one computing initiatives that provide laptop computers to students for in-school and after school use. Mobile, wireless computing programs are designed to help students develop the cognitive tools they will need to compete in the global economy.

Students, especially younger students, are digital natives (Prensky, 2001). They have grown up in a digital environment, and see technologies as basic elements of their environment. Adults are digital immigrants, who have had technology introduced into their lives over time, and who tend to see technology as a tool to be mastered. A laptop initiative can help bridge these differences in the ways that adults and young people approach technology.

A statewide laptop initiative has been implemented in Maine, and one was recently started in Florida (Barrios, 2004). Laptop initiatives also have been implemented in school districts or individual schools in California, Kansas, Illinois, Kentucky, Michigan, Minnesota, New Hampshire, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Vermont and Virginia.

Equity of Access. A key reason that these states, districts and schools have given for starting a laptop initiative has been bridging the digital divide that separates low income and minority children from their peers in access to technology. Children in high income families are four times more likely to use computers than are those in low income families (U.S. Department of Commerce, Bureau of the Census, 2001). Black and Hispanic students are only half as likely to have computer access, when compared to their white and other race schoolmates (U.S. Department of Commerce, Bureau of the Census, 2001). This digital divide persists in the highly wired San Diego region, but is not as large as it is on a national basis. In San Diego, high-income households are 1.5 times more likely to have a computer than is a low-income household. Over two-thirds (70%) of Hispanic households own a computer, compared to 85% of White families (and 81% of households overall). Black families are actually more likely to have a computer at home than is the population as a whole (San Diego Regional Technology Alliance, 2004).

All students must have access to appropriate tools and to challenging curriculum in order to bridge the digital divide. Laptop initiatives address this barrier by providing equity of access at school and at home for all students. In their extensive review of laptop

initiatives, the Florida "Laptops for Learning" Task Force (Barrios, 2004) concluded that, in addition to equity in access, laptop projects must provide for equity of curriculum for all students. A project must not provide an environment of learning with technology for some students, while limiting other students to less interactive learning opportunities.

Impacts on Learning. The Maine Learning Technology Initiative started in 2002, and provides some of the best evaluation information for others considering a laptop initiative. The initial phase of the Maine Learning Technology Initiative (in 2002-2004) provided all 7th and 8th grade students and their teachers with laptop computers, and provided schools and teachers technical assistance and professional development for integrating laptop technology into their curriculum and instruction. Evaluation of the program has found:
- Over 70% of the teachers surveyed reported that the laptops helped them to more effectively meet their curriculum goals and individualize their curriculum to meet particular student needs.
- Over 75% of the teachers reported that having the laptops helped them better meet Maine's statewide learning standards.
- More than 4 out of 5 teachers surveyed reported that students are more engaged in their learning, more actively involved in their own learning, and produce better quality work.
- More than 70% of the students surveyed reported that the laptops helped them be better organized, get their work done more quickly, and with better quality.
- Teachers reported that all types of students are more engaged in their learning and more motivated to learn, particularly at-risk and special needs children. Teachers and principals reported considerable anecdotal evidence that the laptops have had a very positive impact on student attendance, behavior and achievement, although concrete evidence is still sparse.

The Maine Learning Technology Initiative also provided some insight into what happens when a student moves out of the grades targeted for the laptop initiatives (8th graders in the first year of the project then moved to 9th grade, where the initiative had not yet been implemented). A sample of ninth grade students who no longer had laptops reported that they get less work done without the laptops, and the quality of their work has declined without the laptops. (Silvernail & Lane, 2004)

Impacts on Standardized Test Scores. Henrico County Public Schools in Virginia implemented a wide-scale laptop initiative starting in 2001, with all schools scheduled to have laptops by the end of the 2004 academic year. They found that the program did impact their test scores: Their high school score results increased on all eleven of the Virginia Standards of Learning tests. In 2000, only 60% of Henrico County's 60 schools were accredited according to state criteria; by 2003, 100% were accredited. In Michigan, several middle schools have reported significant improvements in standardized test scores in reading, writing, science and math – only one year after implementing a schoolwide laptop program (eSchoolNews, 2005).

Laptop initiatives have not been tied directly to improvements in specific test scores in most areas, however. After studying ubiquitous computing programs for the past 10 years, Rockman (2003) concluded that "We consistently find substantive impacts on teaching and learning, on teachers and students, yet we continue to have difficulty tying full-time access to computers to the outcomes of standardized tests currently in use. Our belief is that, while computers are powerful interventions for both students and teachers, what they do with them is not what is tested." (p. 24).

<u>Developing 21st Century Skills</u>. Relevant, real-world education should include curriculum infused with the skills necessary for living and working in an ever-changing society: information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills (Barrios, 2004). The technology tools found in offices and on the desks of professionals in all fields are the same ones needed to accomplish the work of school: tools for writing, conducting research, stimulating problems, manipulating formulae, making presentations, and organizing information. How students use technology for research, writing and presentations appears more closely tied to the 21st century skills of problem-solving, communications, self-management, and thinking than to standardized tests (Rockman, 2003).

"Developing the ability to learn independently, collaborate with peers to accomplish work, and communicate the conclusions of your work are the core 21st century skills, and a highly valued set of competencies in the world outside of school. These accomplishments are seen in many laptop programs, especially those that allow their students to take their computer home in the evening." (Rockman, 2003, p. 27)

<u>Impacts on Teachers</u>. Teachers comfortable with the traditional "sage on a stage" method of teaching are likely to envision students learning from the technology in the same way they expect students to learn from their teachers. However, to implement an effective laptop initiative, teachers must create instructional environments in which students use higher-order cognitive skills to construct meaning or knowledge, engage in disciplined inquiry, and work on products that have value beyond school (Barrios et. al, 2004). Students must learn *with* technology (constructing knowledge through active learning, collaborative work, information exchange, critical thinking and real-world context) rather than learning *from* technology (knowledge transfer from teacher to student via a single media form of information delivery, with isolated work designed to impart factual knowledge through passive learning).

Initial evaluation of the Maine Learning Technology Initiative found that teachers use the laptops most often in developing instructional materials, conducting research related to instruction, and communicating with colleagues, students and parents (Silvernail & Lane, 2004). Reviewing the impacts of laptop initiatives over a ten year period, Rockman (2003) found a number of consistent changes reported for teachers and their teaching: less lecturing and more individual and group project work; students working more on their own or in small groups, with the teachers acting more as consultants to the group; and increasing collaboration with other teachers.

<u>Impacts on Students</u>. Rockman (2003) also found consistent changes reported for students and their learning: more independent learning and student responsibility for their learning, and more requirements for presentations, which give students experience with the software and regular practice speaking before peers and teachers. Rockman concluded that many students thrive in an environment where they have skills and knowledge to share and to trade. Laptop students also seem to be better students: they take notes while they read, underline or highlight a main idea, write together with other students, re-read papers before turning them in, and use information from a variety of sources.

Writing is the core academic area most clearly influenced by access to ubiquitous computing. Students report using the laptops most frequently in finding information (90%), organizing information (63%), and taking class notes (57%). Overall, student usage was highest in Language Arts classes (93%), Science classes (91%), and social studies classes (88%). Usage is lowest in arts and music. Student use of the laptops for completing class work is higher for students who may take the laptops home (Silvernail & Lane, 2004).

The Maine "Laptops for Learning" Task Force (Barrios, 2004) also found increased student enthusiasm and changes in student attitudes and work habits as results of the laptop initiatives they surveyed. They noted substantial drops in absenteeism (40% decrease in Manatee County; up to 50% in Maine), and that a number of laptop schools also report a decline in discipline problems among students. They concluded that full-time access to laptops seems to encourage responsible ownership of the equipment.

<u>Impacts on Parents and Communities</u>. Rockman (2003) noted that there is often an enrollment surge in schools that announce a laptop initiative. Laptop schools regularly report greater parental involvement (at least for the first few years); higher attendance at PTA meetings; increased communication via email, phone, or face-to-face; more volunteers in the schools; and more participation in tutoring programs and parent-student computer classes offered through the school.   Some laptop programs have instituted parent training on the laptops in an effort to contribute to the economic well-being of the community. Parent satisfaction, support and communication increase in those programs where the laptop is permitted to be taken home (Barrios, 2004).

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