

The experiences of cutting-edge schools suggest the whys, the why nots, and the hows of laptop learning programs.

Going

Mark Warschauer

Laptop computers and wireless networks represent two of the fastest-growing technologies in schools. The state of Maine has adopted a one-to-one laptop program (see Muir, Manchester, & Moulton, 2005), and districts around the United States are experimenting with similar efforts. Is it time for your school or district to consider going one-to-one?

During the last two years, I have served on a team of faculty members, graduate students, and undergraduates at the University of California—Irvine that has been investigating one-to-one

laptop learning programs. We have conducted case studies of 10 schools—7 in California and 3 in Maine—that have implemented such programs (Warschauer, in press; Warschauer, Grant, Del Real, & Rousseau, 2004). The schools are located in diverse rural, urban, and suburban communities; grades covered in the laptop programs range from 3rd to 12th. During those two years of study, we have surveyed more than 1,000 students and teachers; interviewed approximately 200 teachers, students, parents, and administrators; and carried out 750 hours of classroom observations. Here's what we found.

The Why Nots

Let's start by looking at what one-to-one laptop programs are *not* likely to achieve in your district.

Higher test scores. Although there are undoubtedly exceptions to the rule, laptop programs in general have not had any appreciable effect on student test scores. The strongest evidence related to this statement is the state of Maine, where achievement test scores (already among the highest in the nation) failed to rise in the first two years of the state's laptop program. One of the most impressive school laptop programs we examined in California similarly showed no gains in test scores beyond what the same students had achieved in previous years without laptops.

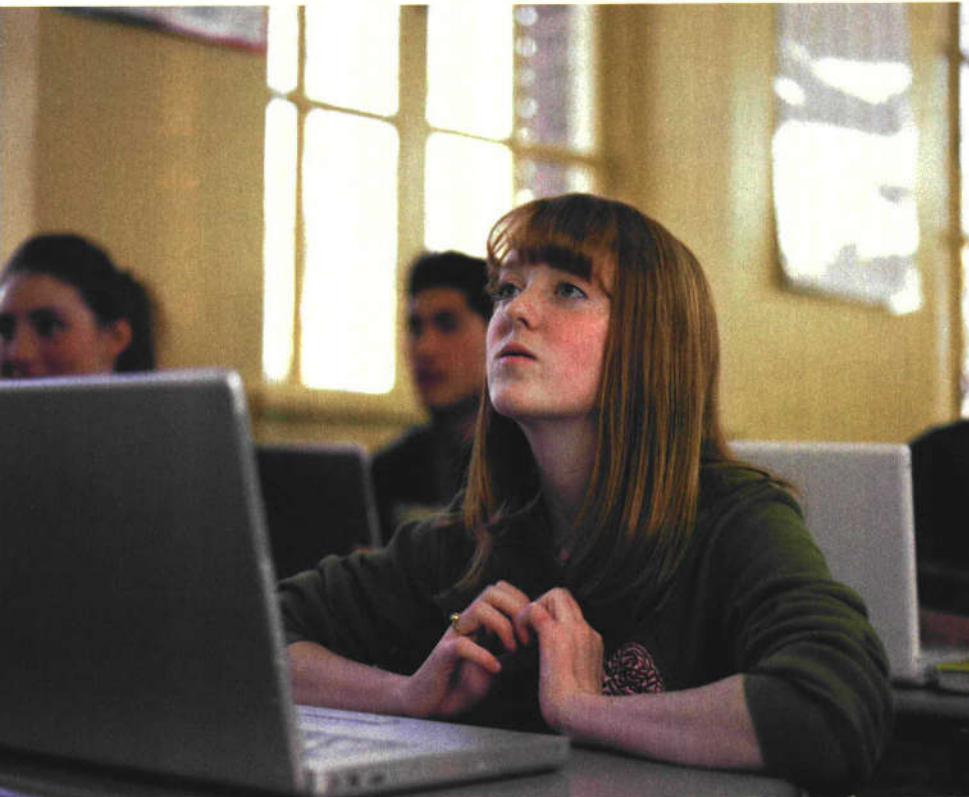
Why would such an expensive and ambitious education effort yield so little in test score returns? First, because the learning advantages that laptops bring to students—through greater ease in searching for information, using multiple media, and revising writing—do not necessarily show up on paper-and-pencil tests. And second, because laptop programs are still in their infancy, and almost any technological innovation takes a number of years to have a full impact.

Reform of troubled schools. Laptops tend to amplify what is already taking place in schools. Whatever a school is doing well, it can probably do better with laptops. By the same token, though, if a school is seriously troubled with discipline problems or unfocused instruction, laptops may amplify those difficulties by giving students a new



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One-to-One



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means for off-task behavior and teachers a new tool for keeping students busy rather than teaching them. Laptops will make a good school better, but they won't make a bad school good.

Erasure of achievement gaps. Laptops can be an important technology resource for students who do not have computers or Internet access at home. But already-privileged students will still have an advantage in working with laptops because of their prior experience with computers; the learning support they have at home; and their more advanced language, literacy, and study skills. This is called the “*Sesame*

Street Effect,” in which an innovation that promises to help at-risk children catch up educationally instead benefits affluent children as much or more (Attewell & Battle, 1999). The bottom line: Learning with laptops can benefit all students, but don't count on laptop programs to erase education inequities in your district.

The Whys

Considering the caveats, why start a one-to-one laptop program? We have found five excellent reasons.

21st century learning skills. Probably the single most important reason to start a one-to-one program is that

laptops facilitate the kinds of learning, thinking, and analysis that today's world demands. Students in the schools we visited had plentiful resources and data at their fingertips; they learned to access that information, analyze and critique it, and work it into a wide variety of authentic products. This kind of learning occurred even more in schools that already valued critical inquiry and had strong information literacy programs, from the classroom to the library.

Greater engagement through multimedia. One teacher we interviewed said that students are “technology sponges.” Actually, we found them to be “multimedia sponges,” whose out-of-school hours are filled with images, video, sound, music, and animation. It is unrealistic to expect students to give up all these things when they walk through the school door. Working with multimedia on a daily basis in school creates higher levels of student engagement—and engaged students spend more time on task, work more independently, enjoy learning more, and take part in a greater variety of learning activities at school and at home. Students in laptop programs also learn to produce and interpret multimodal content, a valuable skill in today's world.

More and better writing. A schoolwide focus on writing can be a powerful lever for raising student achievement across the board (Reeves, 2002) and can also prepare students for high school exit and college entrance examinations. Yet with large class sizes and overburdened teachers, few schools are able to focus on writing as much as

they wish. Students in laptop schools write much more than those in traditional classrooms. They revise their writing more easily and more frequently. They take pride in the professional appearance of their writing. And they receive more feedback on their writing—either because their papers are more accessible to their teachers (think how long it takes to read a handwritten paper compared with a computer-written one), or because, at some schools, they submit their work to automated essay-scoring programs.

Deeper learning. Technology provides students with multiple angles to get at the same material, thus facilitating project-based work that enables them to dig further and deeper. Nearly all the schools we visited reported a greater emphasis on in-depth student research than before. The work we collected from these projects was impressive. The schools often shared student work with parents and community members at public events.

Easier integration of technology into instruction. The teachers we interviewed and surveyed were nearly unanimous in their enthusiasm for the way laptops helped them naturally integrate technology into instruction. With a one-to-one laptop program, teachers no longer have to make do with a few computers in their classroom or wait to schedule a laboratory or a mobile cart. Students can just come into class and pop open their laptops, thus avoiding the delays involved in bringing students to a computer lab or distributing and collecting equipment. After a few months, students in laptop schools gain a high degree of technological sophistication, which allows teachers to focus more on content and less on technology training.

The Hows

OK, you're thinking about starting a laptop program. How do you go about it?

Put education goals first. Be sure to begin by keeping your broader instructional goals in mind. As suggested by the organizers of the Maine program (Muir et al., 2005), make your laptop initiative an education program first and a technology program second. That means you need to spend as much time thinking about the learning goals, curriculum, pedagogy, and professional development as you do about the configurations and the networks. It also means you need to think carefully about the instructional software you

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Although 51 percent of surveyed teachers say that the ideal ratio of students to computers is one to one, only 10 percent say that their schools have a one-to-one ratio of computers to students.

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purchase and the peripherals you choose to support learning (digital cameras, projectors, printers, and so on).

Keep in mind the total cost of ownership. Once you work out all the issues involved in initiating your program, you'll have to figure out how to finance it. In preparing your budget, remember that the total cost of ownership goes far beyond just purchasing the computers. Some of the programs that we studied floundered because they didn't factor in the expense of extra technical support, software purchases, or hardware repair and replacement. On the other hand, in long-term financial planning for your district, bear in mind that as you move

to a one-to-one system, you can probably shut down computer laboratories and reduce the purchase and maintenance of classroom desktop computers. This will allow some savings on space, equipment, and perhaps personnel.

Choose a good vendor. Bid your contract out to multiple vendors, but be sure to keep your broader education goals in mind. Features to look for include stability of the operating system, protection of computers from viruses and security problems, and quality and ease of use of multimedia software. The least expensive laptops to purchase will not necessarily be the cheapest to maintain or the best for educational purposes.

Practice creative financing. How are you going to finance such a venture? The experience of Fullerton School District in California, which implemented a pilot laptop program at three schools in 2004–2005 and is gradually extending the program throughout the district, provides a good example of creative financing. The district's laptop program costs \$468 annually for each student and includes a three-year lease-to-own contract, educational software, a warranty, insurance, and a protective sleeve for each laptop. At the two pilot sites in middle-to-high-income neighborhoods, parents were asked to lease-to-purchase the laptops, and all of them did. The third school, a junior high school in a low-income neighborhood, used Title I funds to lease the laptops. As the program expands to other schools, the district will ask parents to purchase laptops for their children and will put together financial support packages—using state funds, federal funds, or donations from businesses or parent groups—for families that can't afford the purchase on their own.

Leverage student technology talent. Keeping a large number of computers up and running is a challenge. A good maintenance contract is essential, of course, but beyond that, Fullerton's

Nicolas Junior High School has implemented another great idea. Its students take a one-semester NERDs (Nicolas Educational Resource Development students) class in which they learn basic troubleshooting for computer hardware, software, and networks. During the next academic year, they become members of the SWAT (Students Willing to Assist with Technology) team. Members of the team are on call during one of their elective periods each day to go to classrooms and take care of minor problems.

Keep students on task. An Internet-connected laptop can be not only an educational tool but also an MP3 player, a game machine, a pornographic bookstore, and a chat room. Keep students on task by maintaining high academic expectations and creating clear acceptable use policies with well-defined and strictly enforced consequences for violations. In addition, some schools use a management software program that enables teachers or administrators to see any individual student's screen.

Foster teacher collaboration. Learning with laptops allows many new possibilities, both within and across subject areas. The best schools in our study provided regular time for teachers in different content areas to plan, share lessons, and discuss how to coordinate coverage of themes and projects.

Consider block scheduling. Laptops are a natural match with the block schedule. Longer class periods give students the opportunity to delve into research projects. A number of the



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schools we visited combined block scheduling with team teaching, allowing students to coordinate their projects across subject areas. You don't need to rearrange your school's schedule before adopting a laptop program. Instead, you might want to wait until the one-to-one program is in place and then consider scheduling changes that could unleash the technology's potential.

Go slowly. The best laptop programs we witnessed were all phased in carefully, with a good deal of preparation at each step of the way. First steps involve visiting other schools with laptop programs and then determining the best classes, grade levels, or schools for

launching your one-to-one program. Don't feel that you have to implement the program districtwide all at once; first, learn some practical lessons through a well-defined pilot program. Be sure to include adequate professional development, both before the program starts and phased in over the first few years. As you evaluate your pilot program, you can expand from there.

Plan for evaluation. In evaluating your laptop program, keep the program's original goals in mind. Consider partnering with a local university; you may be able to identify faculty members who are interested in investigating laptop-enhanced learning. Consider conducting regular surveys of students and teachers in the program; such online sites as Survey Monkey (www.surveymonkey.com) allow you to collect and analyze survey data online for a small monthly fee, thus eliminating the considerable time and effort required to conduct paper-based surveys.

Laptops for Leadership

Just as pencils, pens, papers, and books were the predominant tools for learning and knowledge production during much of the last century, computers and the Internet are the tools for learning and knowledge production in the 21st century. As computer-to-student ratios steadily approach one to one, some educators are advocating Palm Pilots or handheld computers for the classroom. But the growth of these devices in schools has flattened out (Market Data Retrieval, 2004). This trend is not surprising because the small screens on handhelds make them

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unsatisfactory tools for the kind of writing, research, and multimedia tasks that laptop computers are so well suited for.

All that said, one-to-one laptop programs are still most appropriate for *early adopters* (Rogers, 1995)—successful districts and schools that are ready to take the leap toward becoming leaders in technology use. Laptops are not an instant panacea, but they are a powerful tool for the kinds of learning experiences that will prepare students for the future. Schools and districts that can meet the financial challenge while focusing on broad education goals will find one-to-one computing an exciting and worthwhile venture. **EL**

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