

Technical

Information technology could help schools do more with less. If only educators knew how to use it

and Internet connections across classrooms in the pleasant hope that teachers will integrate them into their lessons. The purpose is seldom to make teachers more productive or to rethink the way in which lessons are delivered. Indeed, PCs often serve as little more than high-priced typewriters, sitting in the back of classrooms unused for most of the school day.

This state of affairs stands in sharp contrast to how technology is used by business and government enterprises that engage in competition with other manufacturers and service providers. To them, technology is not an end in itself, something to be adopted merely because it exists, but a tool for self-improvement. A competitive enterprise adopts new technologies when these enable workers

to tackle new problems or to do the *same thing* as before, but in a *cheaper and more efficient* fashion. For example, technology investments enabled the U.S. Postal Service, under heavy competitive pressure from United Parcel Service and Federal Express, to trim its workforce by 16,000 in 2003. These cuts followed layoffs of 23,000 employees over the preceding two years. The cuts were made possible not by reducing service, but by substituting technology in areas where people were performing either routine tasks or roles that automated machines could handle more efficiently.

In 2000, at the height of the technology boom, Maine governor Angus King made a splash by proposing to give laptops to all of the state's 7th graders. His stated purpose was to "do something different from what everybody else is doing." Missing from the \$50 million proposal, however, was any rationale related to school performance. No evident thought had been put into how this major investment in new technology would make schools more efficient, produce future savings, or enhance the learning process.

King's proposal was typical of the way in which technologies like the personal computer and the Internet have been used in public education. The tendency has been to sprinkle computers

Difficulties

BY FREDERICK M. HESS

Public schools have no reason to regard technology as a tool to trim their workforce or to rethink the ways in which they deliver education – for they face no pressure to do so.

At a broader level, in recent years the nation's 100 largest companies improved productivity so rapidly that in 2003 it took only nine workers to do what ten workers had done in 2001. Economists have long recognized that the potential for growth in productivity is more limited in service sectors like education than in manufacturing or retail. Nonetheless, even the service sector has witnessed productivity gains of about 1 percent a year during the past three decades.

Public schools, by contrast, have steadily *added* to the ranks of teachers and reduced class sizes even as they make ever-larger investments in new technologies. Spending on technology in public schools increased from essentially zero in 1970 to \$118 per stu-

dent in 2002 and \$89 per student in 2003, according to *Education Week*. In 1998 there were 12.1 students for every computer connected to the Internet; by 2002, the ratio had dropped to 4.8 students per computer, according to the Department of Education. In the past five years alone, the nation has spent more than \$20 billion linking schools and classrooms to the Internet through the federal E-rate program with little to show for it in the way of instructional changes or improved outcomes. Meanwhile, despite these huge new investments in technology (see Figure 1), massive increases in the workforce of teachers drove the student-teacher ratio from 22 students per teacher to 16 students per teacher between 1970 and 2001.

Cultural Bias

Why have public schools failed so far to put all this fancy new technology to good use? One clear reason is that they face no pressure to do so. Organizations like the Postal Service make effective use of technology because they must keep up with FedEx, UPS, and other delivery services. Competitive enterprises are on a constant search for ways of boosting their productivity, holding down their costs, and developing innovative products—because they know that their competitors are always on the lookout for similar advantages. No executive wants

to adopt a painful course like downsizing the workforce or imposing wrenching change. They take these steps only when compelled.

Public schools, however, are insulated from the pressures of competition. They thus have no reason to regard technology as a tool to trim their workforce or to rethink the ways in which they deliver education. This problem is compounded by the fact that collective-bargaining agreements between school districts and employee unions have made using technology to displace workers or reinvent processes extraordinarily difficult.

There is also a bias within the culture of education against ideas that seem too “businesslike.” Indeed, the very words “efficiency” and “cost-effectiveness” can set the teeth of parents and educators on edge. Proposals to use technology to downsize the workforce, alter instructional delivery, or improve managerial efficiency are inevitably attacked by education authorities as part of an effort to, in the words of Henry Giroux, “Transform public education . . . [in order] to expand the profits of investors, educate students as consumers, and train young people for the low-paying jobs of the new global marketplace.” The notion that the responsible use of public money is the work of some shadowy global conspiracy evinces a fundamental lack of seriousness about educating children.

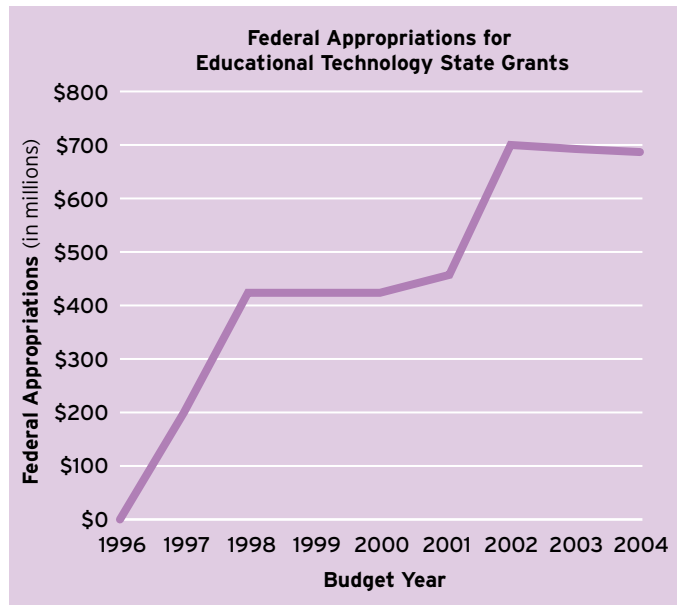
Traditionalists insist that it is impossible to educate children more efficiently, that there is no way technology can be substituted for anything that educators do. They frequently compare the act of teaching to the arts: where the act of creation itself is the end product, it can be difficult or impossible to use technology to improve performance. As the late Daniel Patrick Moynihan, the legendary U.S. senator, was fond of saying, producing a Mozart quartet two centuries ago required four musicians, four stringed instruments, and, say, 35 minutes. Producing the same Mozart quartet today requires the same resources. Despite breathtaking technological advances, productivity has not changed.

In the case of schooling, however, this analogy is incomplete and ultimately misleading. In the arts, what has changed over two centuries is that, through radio, CDs, television, and digital media, the number of people able to *hear and appreciate* a given performance has increased dramatically, at an ever-decreasing cost. Improved technology has now made available to the general public what was once the preserve of the elite.

The spread of the Internet and other technological advances has created similar opportunities in education. For instance, during the 2002–03 school year, the Florida Virtual School enrolled more than 6,800 students in its 75 course offerings. Florida Virtual is a public entity that provides instruction to students in schools and districts throughout the state. The school provides web-based classes, instruction, and assessments to students in a variety of academic subjects and electives. Like virtual schools operating in 15 other states, Florida Virtual allows faculty to provide courses to a scattered student population. Programs like

Investing Without a Return (Figure 1)

Since 1997, the federal government has appropriated more than a total of \$4 billion to make grants to the states for the purchase of educational technology.



SOURCE: U.S. Department of Education

Florida Virtual may make it possible to provide some academic instruction more cheaply and more effectively, freeing up resources for other needs.

At the university level, nearly 2 million students took at least one course online in the fall of 2003. In a national survey of nearly 1,000 college administrators conducted by the Sloan Consortium, 57 percent of the administrators reported that Internet-based courses were already at least equivalent to traditional courses in quality. And a third of the administrators thought that the web-based courses would be superior to in-class instruction within three years. Such improvements are to be expected among the many colleges and universities now competing for students' distance-learning dollars. However, efforts to use the Internet in an effective manner are few and far between among K-12 public schools.

Technology and Data Management

Used wisely, information technology does have the capacity to help schools become dramatically more effective. Data systems that track information on individual students permit teachers to quickly check the performance of individual students on specific tasks. Information technology can also give school-site personnel unprecedented control over budgets and hiring and can increase their flexibility regarding resource allocation. The Learning First Alliance, a consortium that includes the National Education Association and the American Federation of Teachers, has

highlighted how this has worked in districts like Long Beach and Chula Vista, California, and Aldine, Texas.

Outside of schooling, a compelling illustration of how accountability and technology can together improve public services comes from the remarkable success that New York City and other cities enjoyed using new tools to combat crime in the 1990s. The New York City Police Department introduced a system called CompStat, short for "comparative statistics." CompStat compiled data from police reports, crime complaints, arrests, and crime patterns. Over time, the system was broadened to include 734 categories of concern, measuring even the incidence of loud parties and of police overtime.

In the first five years after the 1993 introduction of CompStat, the number of homicides in New York City fell from 1,946 to 629—a rate of decrease three times that of the nation as a whole. Similar results were experienced in other cities that implemented the system, from Philadelphia to Los Angeles. Why did the system work? It helped to hold officers accountable, to pinpoint areas of concern, and to provide the information that can help all police focus on using their skills. In New York City, precincts were required to update their crime statistics on a weekly or daily basis, rather than on the monthly or quarterly basis that had traditionally been the norm. New software allowed department officials to precisely map clusters of crimes, correlating them with drug sale sites, areas of gang activity, schools, public housing, and other relevant locations, and to share the information department-wide within seconds.

In K-12 education, by contrast, we generally manage most information the same way stores managed inventory in the 1960s. Almost unbelievably in this day and age, the typical district spends 40 or more minutes a year per student collecting, processing, and reporting the data required by the U.S. Department of Education under the No Child Left Behind Act. That equates to more than 6,000 hours of employee time in a district with 10,000 students. The tremendous delays in processing data and the staff time consumed are the consequence of districts' having personnel fill out written forms and retyping data from one software package to another. Simply equipping districts to report data electronically and acquire data from existing databases is a daunting challenge.

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When principals or teachers are asked for this information, those that have it available almost inevitably turn to large binders rather than more nimble electronic interfaces. When asked if he could pull some data on teacher absenteeism or staff training costs, one veteran principal in a well-regarded district spluttered, "Do you know what I do if I want substitute teacher data? I have [my secretary] go through the files and tally it up. She keeps a running total on a piece of graph paper for me. . . . If I want to check on a supply order, I call the deputy [superintendent] for services because

we're old friends, and I know he'll actually have someone pull it for me."

Modern information technology offers a wealth of straightforward, time-tested ways to make the necessary data widely and instantly available. There is an array of systems, produced by firms like Scantron and IntelliTools, that allow teachers to call up simple graphs detailing the performance of individual students at the push of a button. However, using these systems requires the consistent collection of information on student learning. Assigning paper-based quizzes ensures that almost all of the information on student mastery will be lost, while the software produced by a dozen or more firms is able to quickly read the results from electronically administered tests into an evolving portfolio of data that tracks student learning.

Ultimately, to be useful, this information has to be at people's fingertips. This is an eminently solvable technical challenge. Huge, complicated organizations, from Wal-Mart to the Internal Revenue Service, routinely track productivity figures, costs, and evaluative measures.

A New Role for Teachers

How else can technology support innovation and reinvention in education? Consider that, historically, teachers have been expected to perform a wide range of responsibilities. Each teacher is expected to design lesson plans, lecture, run class discussions, grade essays and exams, mentor colleagues, supervise homeroom, and patrol the cafeteria. Every year our high

schools have tens of thousands of teachers giving variations of the same lectures on the Civil War, the digestive system, and the properties of quadratic equations. In fact, the job description of a teacher today is pretty similar to that of a teacher in 1950.

In medicine, by contrast, progress has been marked by specialization. Doctors with different types of training have taken on more precisely defined roles while less expensive professionals like registered nurses and physical therapists are now performing tasks that don't require a doctor's training. Similarly, 16-year-old volunteers using handheld scanners are able to track medical supplies and hospital inventory with a precision that would have been unimaginable even in the best-managed enterprise just two decades ago.

Imagine a hospital with no nurses or physicians' assistants or physical therapists, where doctors performed every task. We would need a slew of additional doctors, each would have less time to devote to any particular specialty, and costs would skyrocket.

How can technology enable teachers to specialize in the same manner as, say, doctors? Let's consider one classroom example in order to understand how technology can help teachers use their time more productively. Teachers know it is useful to have students write on a regular basis. When I taught high-school social studies, like so many of my colleagues, I required students to write at least three pages a week commenting on what we had read and discussed in class.

The problem is that, at a minimum, this meant my 150 students would turn in 450 pages a week of writing. A teacher who reads, marks, and comments on each student's weekly work in just five minutes will spend more than 12 hours a week simply providing feedback on such writing assignments. Most of this time isn't spent providing particularly cerebral feedback, but instead flagging obvious grammatical and structural problems and reminding students to write in complete sentences. Meanwhile, teachers also need to prepare for teaching, assess other assignments, assist and advise students, and lead a personal life. The result is often that teachers provide limited feedback, read student work sporadically, or (most commonly) assign less writing than might be ideal.

Once, such compromises were unavoidable. That is no longer the case. Today, for instance, there is essay-grading software, commercially available from companies like Vantage Learning or the Educational Testing Service, that can quickly and efficiently analyze pieces of writing on dimensions such as sentence construction, language, and mechanics. Several of these programs match the scores given by expert human raters more than 90 percent of the time, which is actually *higher* in some cases than the rate of agreement among multiple human readers. How can this be? In most cases, we're not talking about evaluating Proustian prose; we're talking about helping the typical 4th grader learn to write clearly and effectively. Most of the mistakes that students make and most of the feedback they need

are pretty predictable.

Clearly technological tools cannot imitate the full range of skills that a teacher brings when reading a student's essay. Technology cannot gauge a student's growth, analytic prowess, possible interests, or unexpected developments. However, assessment software can replicate the routine elements of evaluation, providing more complete feedback on the essentials while freeing up teachers to make fuller use of their expertise. The result is that teachers spend less time on trivia while adding more value. Rather than requiring hundreds of thousands of teachers to spend hundreds of hours a year circling dangling participles or errant commas, the sensible substitution of technology can help ensure quality feedback while allowing teachers more time for preparation, instruction, and tutoring.

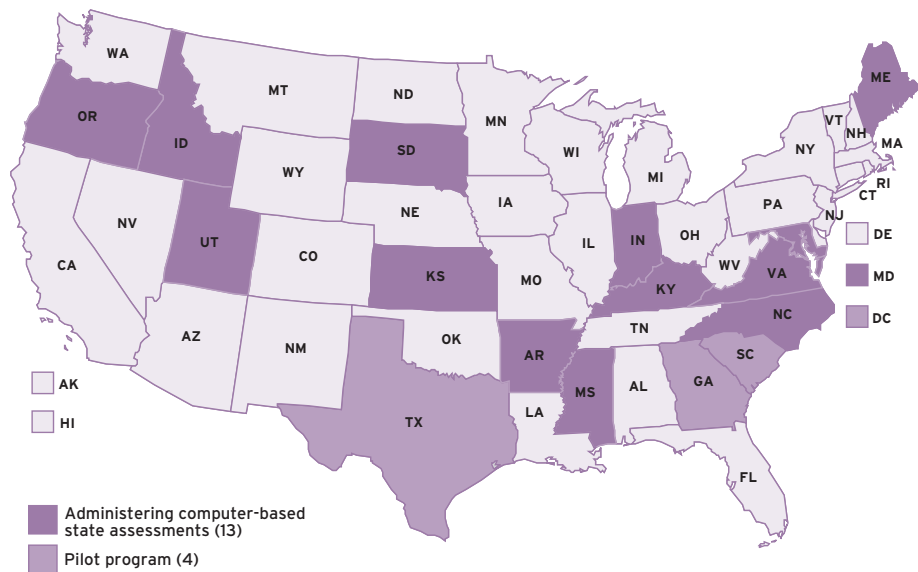
Human ingenuity is the most expensive commodity in the developed world. People are costly to employ; no well-run organization hires reams of bodies when it is possible to hire more selectively and use employees more thoughtfully. This is why efforts to reduce class size are a static, unimaginative, and inefficient way to improve schooling. These efforts presume that teachers need to perform all the duties and tasks now in place; helping them accomplish these tasks more effectively thus requires shrinking the number of students they must teach. However, if we were to retool the teacher's role in a way that used scarce resources like teachers' time and expertise more carefully, teachers could spend more time on the areas where they add value even while working with larger classes of students. If grading essays or examining student performance on weekly quizzes took only half as much time as it currently does, a teacher could work with more students and still have *more* instructional time for each student in that class.

A Tool, Not a Miracle Cure

The nation continues to blithely operate schools in a fashion that was dated in the 1970s and that today would be deemed irresponsible in a toothpaste factory. Rather than demand that education dollars be invested with particular care, we pour money into technology with little thought to how these tools might be used most sensibly.

The Slow March of Innovation (Figure 2)

During the 2003–04 school year, 16 states and the District of Columbia were administering or piloting computer-based state assessments.



SOURCE: Education Week Technology Counts 2004

The ability to instantly share full information on student performance, school performance, and costs across vast distances permits a focus on results that was simply not feasible until the most recent decade. The information technology that makes the easy sharing of information possible is the engine that makes tough-minded accountability, school choice, and visionary leadership a possibility.

Using new technological tools to relieve educators of routine functions will help them focus on those roles that add substantial value—enhancing their contribution, making the organization more productive, and thereby increasing both the benefit to the customer and the resources available to reward employees. Reducing rote demands allows people to focus on what they do best and reduces the number of talented workers who need to be hired—which, in turn, allows us to pay employees more.

Ultimately, if leaders lack the tools to increase efficiency, streamline their workforce, or sensibly reallocate resources, they won't. Technology is not a miracle cure. It is a tool. Used wisely, it can help professionals to take full advantage of their skills, slash the time spent on rote tasks, and concentrate resources and effort where they are needed most.

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