

# The State of IT Education

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**Integrating technology into K-12 schools not only helps prepare students for the 21st century, but it encourages interest in technology. If schools fail to give students this access and to provide the opportunity to learn, the U.S. may not be able to meet the demand for IT professionals.**

Chalkboard lessons and teacher monologues are the mainstay of many of the nation's classrooms. But can this environment really foster interest in information technology and develop the skills that are increasingly necessary in today's workplace?

"In the 21st century, we're still teaching the way we were in the 20th century," said Isa Zimmerman, who was an educator for 40 years in K-12 schools and is a senior fellow at the [University of Massachusetts Donahue Institute](#), the research and entrepreneurial arm of the President's Office. "We're not preparing kids for the world they're going to work in, live in and communicate in. We [just] aren't doing the job."

The first problem is the technology itself. It is fairly outdated and at capacity in terms of what it can handle, said Robert Fenstermacher, head of global education marketing for [Aruba Networks](#), a provider of secure enterprise mobility solutions. Also, the majority of schools still tuck computers away from the classroom in specialized computer labs.

But schools are looking to change this, Fenstermacher said.

"What we're starting to see is [schools and districts] requesting funds either through bonds or [E-Rate](#), so you have devices like laptops in the hands of the students," he said. "Fortunately, there are funds that are coming available to help in [this] transition. [But] most districts would like to roll out technology more pervasively than they are right



now. It's just a vision of how to support that, so they have to take small initial steps."

In Zimmerman's opinion, the first step in integrating technology into the schools is to invest in the equipment.

"When I was a young administrator, I had an argument with a colleague because he kept saying, 'Let's have a plan and teach people how to use technology.' I said, 'We can't teach them to use the technology unless they have it every day because they'll forget what we taught them,'" she said.

"You can't move to the next level without some significant infusion of money," she continued. "Money buys infrastructure, money buys the time for people to learn, money buys the programs for people to use — and those are [all] big pieces of the puzzle."

Keith Krueger, CEO of the [Consortium for School Networking](#), believes that with respect to the first wave of technology — which deals with infrastructure, bandwidth and equipment — schools have made considerable progress. In 1997, only one-third of schools had Internet access, he said. Today, virtually all schools and 97 percent of classrooms are connected to the Internet.

But simply having the technology is not enough.

"It's typically politically expedient to buy computers and call it a day," said Charles Fadel, the global lead for education at Cisco Systems. "But it's not pedagogically sound in most cases, and it doesn't necessarily get very large returns on the investment. It sounds good because it gives the perception of a quick win, but it's not."

Once the technology is in place, teachers need to understand it and then integrate it into the classroom — and that's where a lot of schools fail.

Fadel said information and communications technology can be incorporated into education in three layers. First, teachers must instruct students on how to use the technology to perform basic tasks such as word processing, e-mail and online browsing. Next, teachers must incorporate technology into their lessons; for example, they might use GPS technology during a geography class. And third, educators must teach students through technology — such as immersing them in virtual-world simulations — to create personalized learning experiences.

"By and large, in the best schools, we've only met the first two layers," Fadel said. "Even the second layer is not systematically met across the board in all topics, in all classrooms, with all teachers."

Fadel feels that schools are implementing the latter phases little by little.

"I'm not necessarily sure we're doing it at the right speed, but we're definitely on the right track," he said.

### Is Education Engaging?

Students are texting on their iPhones, networking with one another over the Internet and even blogging on their laptops. They've grown up with technology and are rarely disconnected from it. But their classrooms don't reflect the world around them. In fact, many schools ban the use of Web 2.0 technologies.

"If we take a student perspective and you ask kids how they use technology in school versus how they use it outside of school, the evidence is very clear that the one-word answer would be 'lame,'" Krueger said.

As a result, students might see little relevance in their education and become disengaged. Not surprisingly, this disconnection affects motivation, performance and dropout rates.

Further, without a firm grounding in the use of technology in a professional setting, students are graduating from high school unprepared for the real world and employer expectations.

"Colleges are telling us we're not preparing our high school kids well enough, and the businesses are telling us we're not preparing our college kids well enough," Zimmerman said.

For these reasons, organizations in Massachusetts are trying to make competence in technology part of the licensure requirements for educators.

"Everybody — shoemakers, snow-plow drivers, the physicist who gets the Nobel Prize, the manager who runs a Fortune 500 company — has to know how to use technology," Zimmerman said. "It isn't just the scientists or the technicians.

"That's exactly why the state of technology in schools is so distressing because every youngster needs to have easy access and competence in these new instruments. [And] we need the people in our schools, our educators, to find it just as easy as the kids so that they can use the technology with the kids."

### The IT Shortage

The lack of access to technology in schools also is impacting the number of professionals who enter IT fields. If students don't have access to it, how can they ever consider it as a career?

"If you're in a very poor district and you don't have access to these things, then it will automatically

limit your ability to even think of them as a potential career," Fadel said. "But it's hard to judge how large [the impact] is and to quantify it."

Zimmerman believes it has a big impact because students start dreaming about their careers when they're young, and access to technology can plant a seed for the future.

"The state of technology in some public schools is woeful, and that's where it starts. It starts with the little kids," Zimmerman said. "Somebody once said, 'A Ph.D. starts with kindergarten.' It's true. If we don't

In the United States, however, information technology is not as glorified a career as, say, professional basketball, so students are more likely to dream about being the next Michael Jordan than the next Steve Jobs. Fadel believes this societal perception has a significant impact on the number of people going into IT-related jobs.

"There's the scorn of the geek, which is society-dependent," he said. "Obviously, you're not going to have a technologically advanced society if you have all of [these] factors play against you."

Additionally, many students and parents might assume that IT is a dead-end, given the dot-com bust and, more recently, news of offshoring. It's these misperceptions that affect the number of students entering these fields, said Chris Stephenson, executive director of the Association for Computing Machinery's [Computer Science Teachers Association \(CSTA\)](#).

"We still hear from a lot of students and their parents that they really believe the myth that there are no jobs in computer science," Stephenson said. "In the meantime, we hear from companies that [they] are absolutely desperate for people to fill jobs they already have.

The truth of the matter is, one of the primary reasons many companies are offshoring is because they simply cannot find the people they need here — and that goes back to our pipeline issue."

While the U.S. is not the only country that's experiencing a shortage of IT professionals, it's hard to compare the U.S. with other countries because it's not homogenous. There are some U.S. school districts that are incredible in their use of technology, and there are others that are not.

"In countries like Singapore, it's much easier," Fadel said. "Singapore has a very large city and that's about it. So there are things that you can do [there] that you cannot do in a very large country with a highly decentralized system. That said, Singapore is ahead of most of our districts, but [it is] not necessarily better than our most advanced ones."

### Computer Science in Schools

There's a difference between having access to technology in schools and learning about it.

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get kids interested early on in all the STEM subjects [science, technology, engineering and mathematics], then we lose a lot of potential employees and researchers who will produce for the greater good."

To illustrate her point, Zimmerman shared an anecdote about when she was a superintendent at one particular school.

"[There] were kids who were way ahead of their teachers [in terms of technology]," she said. "They would help teachers find things on the Internet that they could use in their classes. They would help teachers troubleshoot a problem."

This group of students came to be known as the "Internet Scouts."

"Most of those kids went on to become professionals in this field because they were exposed to it, they had access to it, they became competent at it," she said. "[And] they liked it."

"We have to make a really important distinction between using technology as a tool to learn in other disciplines and actually learning computer science itself," Stephenson said. "What often happens is these two become very much confused in the view of administrators and the public. What we see is a misconception that as long as there are computers in the schools, students are learning skills that are appropriate to meet the future needs of the high-tech industry. Unfortunately, that just isn't the case."

Computer science courses are one way high school students can get interested in and learn about technology and the industry, but many computer science programs are in poor shape.

"We're not getting enough students into the computer science pipeline early on because there aren't teachers who can teach it, or there aren't courses that students can take," Stephenson said. "As a result, there are not enough students going into computer science or informatics [in] college or university. The end result is we're simply not graduating enough people to keep up with the needs of industry."

The problem lies in the certification process for computer science teachers. The systems for certification that are in place are completely out of touch with the needs of students and the discipline itself, Stephenson said.

"In the vast majority of cases, the current state certification requirements for CS teachers are either incomplete or completely irrelevant," he said. "You have situations where teachers who teach computer science cannot be certified as computer science teachers."

As a result, students are not getting the best computer science education. Stephenson has heard of instances in which schools ask teachers from other disciplines to teach the computer science course, even though the two subjects may have little or nothing in common.

"They spend the whole year just keeping one step ahead of their students, trying to learn faster than [them] so they can teach it," she explained. "When you're talking about a discipline like computer science where the technology is changing constantly, it's really hard for teachers without a background to teach it appropriately."

Additionally, because computer science is not a core subject outlined in the [No Child Left Behind Act](#), former President George W. Bush's education initiative, students are not required to take it.

According to CSTA's National Secondary Computer Science Survey, 78 percent of the 14,000 people surveyed said their school offered introductory computer science courses in 2005. In 2007, 73 percent of the 13,000 people surveyed said their school offered introductory computer science courses. Similarly, in 2005, 40 percent of respondents said their school offered Advanced Placement (AP) computer science classes. In 2007, only 32 percent said their school offered AP computer science classes.

"With No Child Left Behind, schools are only concentrating on core courses, so they're offering fewer and fewer electives," Stephenson said. "As long as computer science is considered an elective rather than a core course, it's going to be harder and harder for schools to offer it. Computer science is kind of like the canary in the coal mine: When things get tough, it's the first to disappear."

Yet, if high schools and colleges don't produce enough people interested in these fields, there won't be enough people to meet the demand. According to the [U.S. Bureau of Labor Statistics](#), employment of [computer software engineers](#) is projected to increase by 38 percent from 2006 to 2016; employment of [computer scientists and database administrators](#) is expected to grow 37 percent; employment of [computer systems analysts](#) is expected to grow by 29 percent; and employment of [computer support specialists and systems administrators](#) is expected to increase by 18 percent.

And this IT shortage may affect the United States' competitiveness, as the Googles and Microsofts of the world will relocate or sprout up elsewhere.

"If the situation continues as it is, we will continue to see the industry [struggle] to find the people they need to fill the jobs they have," Stephenson said. "We will see North America diminish in terms of its competitiveness in all of the fields that technology [and] computing touches. [And] countries that are making an effort to get more people into and through the pipeline are going to gain the edge." 

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