

## **It's Not About the Technology**

by Barry J. Fishman — July 06, 2006

There are many compelling uses for technology in education. Across the educational landscape, a broad variety of extraordinary teachers and exceptional schools employ technology to transform student experiences, facilitating deep engagement and meaningful learning. But take a moment to re-read that last sentence. Note the words “extraordinary” and “exceptional.” These are words one commonly hears associated with teachers and schools where technology is used in ways that truly enhance learning. My goal is to be able to someday re-write that sentence so that we can report that technology is helping ordinary teachers and schools to do extraordinary things. Why is this not the case today? How can we make it so? I argue that there are two critical elements to be addressed in educational systems before technology will broadly benefit student learning: (1) We need to reframe how we think about teaching and learning in school; and (2) we need to get serious about teacher learning and professional development. But first, I want to examine the current landscape with respect to technology in education.

### **Technology: The State of the Scene**

According to current data from the National Center for Education Statistics, in 2003 nearly 100% of schools were connected to the Internet, and there was an average of one Internet-connected computer for every 4.4 students. A small but growing number of schools and districts go beyond these numbers by providing every student with a laptop or other computing device. Handheld computing devices (Palms and PocketPCs) have received a lot of press as an alternative way to make technology available to every student. Interactive whiteboards are beginning to spring up across the landscape, and course management and delivery tools (such as Blackboard) are increasingly used to provide online courses at both secondary and post-secondary levels. Sounds good, right? Technology is really becoming pervasive in schools, isn't it? The answer is an unqualified “yes and no!”

Yes, we do have a lot of technology in schools, but the problem with the numbers in the preceding paragraph is that they're all about stuff. And that's a major problem with technology; people and schools and policy makers too often rely on inventory or census-like reports of technology in schools as the most significant progress indicator, as opposed to focusing on the more important but more difficult question of how learning is changing as a result of technology use. A related issue is what kind of stuff schools tend to focus on when they talk about technology. There are two problems here: technologies that are not designed for educational environments, and a growing gap between what schools consider appropriate technology and the technologies that kids (and many teachers) actually employ in their everyday lives. In trying to address the first problem, my colleagues Elliot Soloway and Chris Quintana have conducted research into “learner-centered design” for technology. Learner-centered design emphasizes that users are learning both the content area and the software (or other processes) at the same time, which is different than the needs of professionals, for instance, who already know their domain and are looking for tools to apply to it. Learner-centered design also emphasizes that tools work best when they can be used pervasively throughout a student's school experience. That way schools don't have to continually re-invest time in having students learn new tools. The second problem has to do with the growing gap between what schools consider “acceptable” technology and what kids actually use. Cell phones, digital media players and a growing number of “Web 2.0” technologies for collaboration and participation represent tremendously powerful opportunities to harness new kinds of learning, but schools' initial response to a new medium is usually to try and block or ban it, rather than to try and harness it. This particular topic would require an entirely different commentary to address properly!

The focus on technology-as-stuff is reflected in many school technology plans (documents that are now required to be on file in many states in order to establish eligibility for various funding programs), which frequently look like a cross between a shopping list and an infrastructure planning document. Only rarely does one encounter a technology plan that links a school's teaching and learning goals to an understanding of how technology can help them achieve those goals, by transforming the shopping list into a functional document. The best technology plans are windows into how a school intends to teach with technology. Fortunately, in my own work I am encountering an increasing (but still small) number of schools that have come to think about planning in just this way. Part of the challenge is that creating a useful, functional, and living planning document takes a lot of work, and the work needs to be viewed as ongoing. But slowly, school leaders are starting to understand that this is what it takes to be successful.

Though technology is becoming a widespread presence, it is not for the most part central to the curriculum of schools. It is primarily used as an adjunct or add-on, broadly underutilized in terms of its potential, and certainly in terms of the investment. In many cases, we find technologies used to support students and teachers doing exactly what they have always done, but in a flashier way. Electronic whiteboards come to mind as a prime example of this, with many teachers using them to facilitate drill-and-practice and recitation types of activities, just as they would have done with traditional blackboards. Proponents argue that the new technologies are more attractive and motivating for students, but these effects are not long-lived. A better argument for investing in technologies is that they are more cognitively engaging than what came before; they enable us to teach differently, to engage more deeply with content, to support knowledge-building and discourse. But using technology to support these goals is a lot more difficult than a stuff-oriented approach to technology, both to create and to document.

### **Technology Needs Reform More than Reform Needs Technology**

What do I mean by this heading? Simply this: Technology employed for "business as usual" leads to the usual outcomes. You don't create improvements in teaching or learning by introducing technology; you create improvements in teaching and learning by improving teaching and learning! In other words... reform. Reform is hard; that is not news to anyone. What is surprising is that many people think that technology offers shortcuts to reform. While it is true that technology can act as both a catalyst to and provide support for school reforms, it is also true that technology does not make the overall process any easier. Some would argue that it makes the overall process harder, "one more thing for teachers to focus on." But if this is the case, I would respond that you're going about it the wrong way. While learning how to use technology is a challenge for teachers, it need not be an insurmountable barrier to the success of any reform, especially when we're talking about a reform where the point is not simply the introduction of technology, but a larger goal, such as fostering increased inquiry, or better writing processes, and so forth. My own experience is that technology can have a profound impact when it is used to support changes in teaching that lead to greater student ownership of ideas, increased collaboration and communication around ideas, and an increased focus on deep content knowledge learning.

An example of a technological tool that can support this type of learning is SimCalc, developed by James Kaput, Stephen Hegedus, and Jeremy Roschelle. SimCalc aims to democratize access to big mathematical ideas, by making it possible for students to begin working with core ideas from calculus such as rates of change, variation, mean values, and approximation, as early as middle school. Why do this? Because it connects early math learning to ideas usually reserved for an elective course at the end of one's math career, unlocking key ideas not only for domains like engineering and science, but

also for informed citizenship. SimCalc employs easily manipulated graphical representations and contexts with which young students can understand and experiment. Kaput and Roschelle's research has demonstrated the value of using SimCalc tools in a classroom environment built around mathematics inquiry, but they also worry that SimCalc may not scale up to a broad variety of teachers and settings. To address this challenge, the researchers' most recent work involves a replacement unit that is intended to be an easily adoptable introduction to SimCalc. In a large-scale randomized experiment, the researchers will examine whether a wide variety of teachers can use SimCalc to help students learn challenging math content; additionally, they will try to learn what additional supports teachers—those unsuccessful with the use of SimCalc—might need in order to succeed.

In my research group at the Center for Highly Interactive Classrooms, Curricula, and Computing (hice; <http://www.hice.org/>), we have come to think about the introduction of reform-oriented innovations like SimCalc as a kind of “usability” problem. Computer scientists think about usability as a measure of the extent to which you can use a tool (e.g., software) to accomplish a given task. We have all encountered powerful tools where the interface actually makes it harder for us to do what we want—think of a cell phone where you can't figure out how to get the number you've dialed to go through. This is a usability problem. I find it useful to think about reform-oriented innovations for education in the same way. How usable is a certain reform idea by those it is intended for? In hi-ce, we have found it helpful to consider usability along three dimensions, which together represent the capacity of an organization: capability, culture, and policy. Capability represents the skills one has, or needs, to succeed with the reform ideas. Does a new curriculum include web-searching activities? Do you know how to use a computer? Do you know how to use the Internet? Culture represents the norms of the community where the reform is intended for use. Does the reform require a lot of parental involvement? Is it common for parents in your community to be active in the school? And finally, policy represents the management structures and rules that govern the school. Does the reform require that students have daily access to computers? Are computers in your school available for students to use in classrooms? Or are they kept in separate labs that teachers need to sign up for? These are just some examples of the kinds of gaps that can exist between the demands of reform and the capacity of teachers or schools to enact the reform. If there are gaps, that translates into a usability problem. The implication of this way of thinking is that to increase the chances that any particular reform will succeed, it is important to consider what the capacity of your organization is and what the demands of the reform entail. This is a two-way street, in which it might be necessary to alter some aspects of the reform (being mindful not to undercut its original intent), and to work for reforms within schools to reduce the size of gaps by changing policies, focusing on culture issues, or working on the capabilities of individuals within the organization.

### **Teacher Learning and Technology**

The best way to improve individuals' capability is through professional development, which is widely recognized as key to the success of instructional reforms. Ironically, this development is often not well-supported or conceptualized in reforms involving technology (this may in fact be the case across the board, but I'm only focusing on technology here). Though empirical support is still emerging, we do have a good sense of what effective professional development requires: It should focus on specific content and learning goals for students, examine student thinking and performance, provide teachers with opportunities to observe, practice, and reflect on new techniques, be conducted over extended periods of time, and foster the growth of the professional community that can support ongoing learning by providing roles for both those who have already gained proficiency in the new approach and those who are newcomers to it.

Where technology is concerned, too much professional development is generally short-term at best. It is often provided by outside agents (frequently the company that sold the technology to the district) who are not well versed in the curriculum or particular challenges of the adopting district. Also, it is conceptualized not as ongoing development, but as more limited “training” to use the technology. One of the key lessons to keep in mind about technology-related professional development is that learning how to use technology and learning how to teach with technology are two separate challenges. Successful professional development with technology needs to focus on teaching and support teachers in learning how to use the technology in the context of their teaching. The same tools that help students engage deeply with content knowledge can also motivate teacher engagement with content knowledge, a key component of successful professional development.

Technology has been suggested as a vehicle to support teacher learning. Online professional development courses or workshops may in fact be a way to create high-quality professional development that is both scalable and sustainable. But two things need to be kept in mind: First, teachers need to learn how to use the technology for professional development, just as they need to learn how to use it in their own teaching. It is clear that many teachers are not comfortable with online technologies, and will require extra time and support to become comfortable. Second, the efficacy (in terms of its impact on teacher practice and student learning) of online professional development is as little understood as that of face-to-face professional development. The bulk of research on online professional development thus far has focused on issues such as participation patterns and teacher discourse. I am just now embarking on an NSF-funded study together with my colleagues Danny Edelson and Spyros Konstantopoulos that seeks to empirically study the impact of professional development both online and face-to-face, in the context of teachers learning to use a technology-rich and inquiry-oriented environmental science curriculum. We will be looking for patterns in teacher beliefs and knowledge change related to the professional development, but also for changes in their classroom practice and in their students’ learning outcomes. Results from this study are still several years away, but our hope is that we will be able to shed some much-needed light on the question of how technology can support teachers’ learning and teaching in meaningful ways.

### **A Final Thought**

From what I’ve written here, you might think that I am pessimistic about the potential of technology to help us improve our educational systems. Based on my own research and experience, and the research of many colleagues in the learning sciences and related fields, I firmly believe that technology can transform teaching and learning environments and help students achieve beyond what is possible without the support of technology. What I am concerned about is the current common usage of technology in schools. It is a tremendous challenge to translate knowledge about teaching with technology from schools that are currently doing **extraordinary** things—both on their own and in the context of focused research projects—into knowledge that is broadly usable by the majority of schools. Nonetheless, it is a key challenge that must be met in order to employ technology effectively in school improvement efforts.

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