Technology Supports for Lifelong Learning

Allan Collins

Northwestern University

Richard Halverson

University of Wisconsin, Madison

February 2009

All around us people are learning with the aid of new technologies: children are playing complex video games, workers are taking online courses to get an advanced degree, students are taking courses at commercial learning centers to prepare for tests, adults are consulting Wikipedia, etc. New technologies create learning opportunities that challenge traditional schools and colleges. These new learning niches enable people of all ages to pursue learning on their own terms. People around the world are taking their education out of school into homes, libraries, Internet cafes, and workplaces, where they can decide what they want to learn, when they want to learn, and how they want to learn.

The emergence of alternative venues for learning threatens the identification of learning with school. The tension between new forms of learning and old forms of schooling will not be resolved with the victory of one or the other. Rather, the seeds of a new education system are forming in the rapid growth of new learning alternatives such as home schooling, learning centers, workplace learning, distance education, Internet cafes, computer-based simulation, technical certification, and adult education. This does not mean that public schools are going to disappear, but their dominant role in education will diminish considerably.

The changes that are happening in education are neither all good nor all bad. There are many benefits to the kinds of education that technology affords, such as the ability of learners to pursue deeply topics of interest to them and to take responsibility for their own education. But at the same time some of the effects of technology on education are problematic. In particular, the new technologies can undermine both Thomas Jefferson's vision of educating citizens who can make sensible public policy decisions, and Horace Mann's vision of a society where everyone can succeed by obtaining a good education. Increasing the ability to personalize educational opportunities gives a natural advantage to those who can afford the services. Citizenship and equity may be undermined by the fragmentation and commercialization afforded by the technological revolution. The goal for society should be to ward off the dangers and exploit the possibilities

New Niches for Learning

The seeds of a new education system can be seen all around us. Many of these seeds will affect the learning of children, but many others will affect people at all ages, as learning becomes a lifelong enterprise. The face of education is changing rapidly, and it remains to be seen exactly what form it will take.

Home Schooling

Technological advances have fueled the development of home schooling, though they did not give rise to the movement. Internet curriculum materials help organize learning content, leaving parents and others to play the role of facilitators. Virtual charter schools, such as Florida Virtual Schools, provide some of the administrative and curricular structures to support home schooling through distance education. Most K-12 schools have managed to keep technology at the periphery of their teaching, in courses such as keyboarding, tech prep, and computer programming (Cuban 2001). It seems technology fits much more comfortably into the home environment than into the school environment.

Parents of home schoolers may in fact be more helpful than teachers in a context where the content of what students are learning is embodied in computer and video-based materials. Teachers view themselves as experts, whose role is to convey their knowledge to students. In contrast parents do not think of themselves as experts and hence take on the role of a coach more naturally. The role of coach puts more responsibility for learning onto the student. The parents are there to help the student figure things out and to encourage the students to work hard, but they usually do not take on the role of explaining everything to the learners. Hence figuring things out for themselves becomes a major job for home-schooled kids.

Workplace Learning

Recently both the military and corporations have been building simulations around popular online video games, using the tools that have been developed for creating these games. The military, in particular, has used game design as a path for recruiting and training a generation that grew up on video games. Companies have also picked up on the potential of games for training. Canon, for example, has developed a simulation where technicians must repair simulated copier machines that have different faults inserted in them. In one Cisco game, players must put together a computer network on Mars. The companies have found the games are more effective than traditional methods for teaching critical skills.

One can imagine a day when most of the training that workers get for their jobs bypasses traditional educational institutions and takes place in online environments. Sales people might practice their skills with simulations of recalcitrant customers. Doctors might practice their skills trying to diagnose unusual cases. Future travel agents might be challenged to develop cost effective trip plans using the web. In fact almost any job-related skill can be taught by practicing the skill, and computer simulations can create immersive environments where the target skills are necessary for solving engaging problems. More and more workplaces are investing in such simulations. It is likely that future workers will have to spend much of their time learning, as workplaces keep introducing new processes, techniques, and equipment. Workers may spend their whole lives learning in order to survive in a changing workplace.

Distance Education

Distance education has been around a long time. Correspondence courses have reached thousands of students over the past century. However, the Internet is pushing new kinds of interactive distance education at both the K-12 and collegiate level. The University of Phoenix, for example, is famous for having tens of thousands of online students all over the country (Maeroff, 2003). Leading universities, including Stanford, Harvard, MIT, and Carnegie-Mellon offer a variety of courses to distant locations. The model of the Open University in the United Kingdom has spread across the globe. Venture capital firms have been investing millions of dollars to develop distance education. In addition almost every state has developed virtual high schools to provide courses to students that are not offered in their own schools. Distance education has already spread widely, and it will inevitably keep growing in the coming decades.

As busy people realize they need more education, they increasingly opt to take distance education courses. Often people find that to advance in their careers, they need another degree, and distance education courses provide the easiest means to obtain that degree. Although

distance education has a head start in adult education, the recent development of virtual K-12 schools will provide future challenges for the brick and mortar public schools.

Learning Centers

Privately owned learning centers are growing to fill gaps in the existing education system. These are currently most common as preparation for taking national tests, such as the SAT and ACT, and to provide tutoring for children who are having problems in school. Learning centers are also beginning to develop for adult education. Princeton Review, Sylvan, Thompson, and Kaplan are only some of the companies that provide learning centers. Some of these companies are setting up centers in towns and cities, where people can go to prepare for some kind of test or to get specialized teaching in some area of weakness. As they develop, learning centers are likely to employ more and more network-based education and will spread as a way to obtain specific knowledge and credentials.

Learning centers are also making an impact on career education. In the 1990s the U.S. Department of Education launched an initiative to support non-profit community technology centers to serve communities, where access to computers and other technologies is very limited. The community technology center network (http://www.ctcnet.org) now has over 1000 centers in many different locales, such as housing projects, storefronts, community organizations, and libraries. Most of the participants are minorities, a large proportion of which are African American and Hispanic women. They range in age from 13 to 91, half between 20 and 31 years of age, but with a large number of teenagers as well. Most come to learn job skills and take classes at the centers, as well as to use the Internet facilities. Many acquire improved English language skills, get tutoring and homework help, or participate in GED and other adult education programs. They also use computers to get information from the Internet, send and receive e-mail, set up Web pages, and carry out their own self-directed projects.

Learning centers, whether non-profit or for-profit, are spreading widely. They usually offer classes, as well as providing access to technology. They are oriented to providing specific knowledge and skills, which the users want to obtain. Learning centers are likely to proliferate in the coming years.

Computer simulations

The advent of home computers has led to a proliferation of learning software, some on CD-ROMs and some on the Web. The most famous of these are the Sim series, developed by Maxis: SimCity, the Sims, SimLife, SimEarth, SimAnt, etc. In SimCity you are put in charge of developing and running a city, as a kind of dictator. Depending on your decisions, the city and its people may thrive or may deteriorate. People who spend time playing the game are learning some of the tradeoffs involved in the dynamics of a city. SimLife similarly teaches about the ecology of systems, SimEarth about the dynamics of geology, and SimAnt about the behavior of an ant colony. The Sims allows people to design a human character to represent them and see how the character's actions play out in a simulated world. It is one of the most popular games now on the market. The Sim series are engaging games that teach a variety of subjects, but how much children learn from playing such games depends on how much they think about the ideas and issues the simulations embody.

An understanding of video games as learning environments is becoming increasingly important as gaming culture rivals schooling for the attention of children and adolescents across the world. James Paul Gee (2003) argues that the compelling nature of video game participation is in part due to the underlying social, cognitive and developmental learning principles around which successful games are built. With this perspective, games and gaming can be a source for inspiration in building more effective learning environments.

Given this popularity and the compelling nature of game-play, program designers should be able to draw on games and the principles of game design to build more compelling learning environments. In the best selling game *Civilization*, for example, players have the opportunity to relive the development of global social and economic history. Players must plan, choose to negotiate or fight, acquire and allocate resources, and make decisions to advance their civilization. Taken together, these activities point toward how students can integrate theories and practices from across the curriculum in playing a compelling historical simulation. Kurt Squire (2004) notes how games like *Civilization* can provide opportunities for students, who are traditionally not engaged in learning history, an opportunity to "replay" history. Students can investigate, for example, what would have happened if Africans, rather than Europeans, colonized the Americas, and can begin to understand what theories of social change look like in action, rather than in books.

There will be a steady accumulation of learning software for both kids and adults. For a generation that has grown up with sophisticated game simulations, learning with technologies is likely to come more easily. Gaming may help them learn a variety of leadership skills, such as resource allocation, negotiating with friends and adversaries, manipulating situations and environments, actively pursuing their goals, and recovering from failures. As John Seely Brown (2006) has suggested, the gamers of today may become the leaders of tomorrow.

Technical Certifications

In recent years a host of companies, such as Microsoft, Cisco and Novell, as well as technical societies, have started to muscle in on the certification process by offering exams that certify the mastery of technical skill in computer-related occupations. The Cisco Networking Academy (http://cisco.netacad.net/public/academy/), for example, provides a comprehensive training program for network administration. The Cisco Academy is based on a tight linkage of curriculum, learning-by-doing, and assessment activities that are coordinated in a learning environment that blends Web-based and classroom learning. Rather than expecting schools to train students with necessary skills, the Cisco Academy partners with schools for classroom space and access to interested students. They have trained over 400,000 students in 150 countries with a curriculum translated into nine languages. Certification programs like these have in turn led to a number of training programs in commercial colleges and community colleges and on the Web to prepare students for the certification exams. These certification programs provide an alternative to technical degree programs for students, who may struggle with the academic focus of high school and colleges.

These certification programs over the long run are a threat to the monopoly of schools and colleges. Because the certifications are more specific, they are in fact more meaningful to potential employers. They specify just exactly what skills a student has acquired in a way that a high school diploma or a college degree cannot do. Furthermore, because the certifications are so

specific, it is possible to tailor any educational program directed toward them much more carefully. In fact, the companies and technical societies that are developing the certifications have in many cases developed very clear specifications as to what and how courses should be taught to prepare people to take the certification exams.

<u>Internet Cafes</u>

All over the world Internet cafes are springing up, where people can go and log on to the Web for a small fee. These cafes are the libraries of the future. They particularly attract young people who spend hours on the Web, engaging in conversations and games, reading about what is happening in the world, learning how to program, or exploring different sites that relate to their interests.

More and more of the world's accumulated knowledge is spreading to the Web. Hence, with access to the Web in many locations, people can begin to educate themselves. This is the role that public libraries have played in the past. As people all over the world see the necessity of an education to prosper in a technological society, they are likely to start teaching themselves through the resources of the Web. Inexpensive access to the web through cafes provides the whole world access to knowledge, new social arrangements, and new ways of thinking about learning. Of course it also provides a venue for kids to waste an enormous amount of time.

Fostering Self-Directed Learning

The web gives children and adults the ability to pursue topics they are particularly interested and feel passionate about including topics such as quasars, Chinese history, Japanese anime, cuneiform writing, Viking ships, and casino games to name just a few. These are topics learners never encounter in school unless they pursue them later in college. Nor are they likely to find people among their acquaintances who share their interests and would study the topics together with them. Such exotic topics remained as lone pursuits for most people until the web came along.

Virtual communities make it possible to bring together people from all over the world with common passions. Their communication can take place over electronic mail and in computer news groups, social networking sites, or Multi-User Virtual Environments (i.e. MUVEs), such as Moose Crossing created by Amy Bruckman (2002). In these different computer-based environments people of different ages are getting together around topics that they are passionate about. This enables them to learn about their passion much more deeply than they can on their own. Often people cannot find others locally who share their passions, but the reach of the Internet allows them to go beyond their local community to find like-minded communities.

Brigid Barron (2006) provides a good example of how students can become self-directed learners through exploring their interests on the web. She finds that they use a number of different strategies for learning on their own. For example, one middle-school girl in California named Stephanie, who was the daughter of Chinese immigrants, had a group of friends who used GeoCities to create their own web pages. They taught Stephanie how to use HTML, which appealed to her since she liked to draw. Then in seventh grade she took courses in programming, web design, and industrial technology, where she used a computer to do designs. In eighth grade

she decided to develop a web page for her family and helped her father design a web page for his new business. She even taught her mother different ways to use computers. As she got further into art with the computer, she lurked in the background of Xanga, an online blogging community, trying to pick up techniques for making computer art. She would study the finished works and the source code the artists used to produce their works. Stephanie's case exemplifies the wide variety of strategies kids use to learn on their own. Learning to be a self-learner though participating in a variety of learning contexts will help more students like Stephanie to develop the skills necessary to choose learning contexts well.

The phrase "*The Long Tail*" was first coined by Chris Anderson in an October 2004 *Wired* magazine article to describe how modern culture is increasingly shifting away from a focus on mainstream products at the head of the demand curve and toward a huge number of niches in the tail (as exemplified by Amazon or Netflix, that sell a large number of unique items in relatively small quantities). The web enables long-tail learning in a variety of ways by supporting participation cultures among the members of communities interested in idiosyncratic topics. Novices can lurk in these communities to pick up the issues, techniques, and jargon that sustain the communities. When learners develop expertise, they can display their work or their thoughts to the community and get feedback from the community to guide their further development. Finished products might later get posted on YouTube or Epinions, where the world might see their work.

Another way the web enables long-tail learning derives from the plethora of information available on the web. When learners go into most libraries, they are likely to find a limited amount of information on any topic, the information they find is very likely out of date for most topics, and there is rarely documentation on the techniques the community of practice (Wenger, 1998) around the topic are using. Based on the fact that the web is both constantly evolving and actively filling up all the long tails of knowledge about every conceivable topic, it can support long tail learning in a way not even the largest library in the world can support. In addition, the web can provide expert audit trails, active simulations, and tutorials on topics that support learning well beyond what learners can glean from books.

Conclusion

When taken together, the cumulative effect of these innovations is to extend learning throughout life and over many venues, unlike schooling. With time, these pieces might come to comprise the fragments of a new system of education in which schools are pushed to the peripheral role in learning they once occupied before the industrial revolution. But these elements have developed independently of one another. They do not in any sense form a coherent system of education. That is where the need for visionaries is most apparent. It will take a new group of energetic visionaries, to once again do the kind of work that Horace Mann and his colleagues did -- that is to figure out how to build an equitable and coherent system from these emergent technological pieces.

Eventually when people and politicians become worried about what kids are learning or what adults don't know, their automatic reaction may not be "How can we improve the schools?" Instead they may ask, "How can we develop games to teach mechanical engineering?", "How can we make new technology resources available to more people?" or " What kinds of tools can support people to seek out information on their own?" These are all questions that push the

envelop for improving education out of the schools and into new venues. The link between schooling and learning forces our conversation into institutional responses - we don't yet know how to ask wider questions when we think about improving education. These issues are discussed in length in a forthcoming book (Collins & Halverson, in press).

The new view of education is structured around the idea of *lifelong learning*. Lifelong learning requires moving away from schooling institutions that structure individual learning. Instead, learners need to act as consumers of a wide variety of learning experiences. Learners will need to develop the skills to judge the quality of learning venues and to develop the kinds of social networks that provide guidance and advice.

The recent explosion of social networking points to how technologies can replicate the support and guidance functions of schools. For example, user groups and community sites exist for every known disease and disorder, and doctors across the country know their diagnoses are checked by an increasingly informed patient population. These kinds of social networks are blossoming around topics of particular interest to different groups of people: topics such as poetry, chemistry, digital graphics, and fantasy sports. The networks draw people across all ages from very different backgrounds, some quite expert and others virtual novices. Some learn by lurking in the background and others by asking questions. Groups in the network may jointly investigate topics of interest or argue about issues they think important. The successful sites, however, share the characteristic of providing useful information to guide the interests of users. Reliable information sites are already supplanting the guidance departments, financial aid centers, even tutoring and homework services provided as common staples of institutional schooling.

If schools cannot change fast enough to keep pace with advances in learning technologies, learning will leave schooling behind. With inexpensive computers, young people in Thailand and Brazil can have access to the same resources for learning that people in the developed world now have. Many will choose to take advantage of these resources to escape from poverty. In some ways they will be a new kind of 21st century immigrant - instead of moving to a new country, they will use information networks to transform their thinking. They will be able to find like-minded souls to share ideas in cyberspace. This new approach to learning that is developing among people around the world will be highly interactive, very personalized, and give the learner much more control over their own learning.

References

Barron, B. (2006*)* Interest and self-sustained learning as catalysts of development: A learning ecologies perspective. *Human Development, 49*(4), 193-224.

Brown, J. S. & Thomas, D. (2006, April). You play *Warcraft*? You're hired! *Wired, 14*(04). Accessed online at http://wiredmag.com.

Bruckman, A. (2002) Co-evolution of technological design and pedagogy in an online learning community. In S. Barab, and J. Gray, Eds., *Designing virtual communities in the service of learning*. New York: Cambridge University Press.

Collins, A. & Halverson, R. (in press) *The second educational revolution: How technology is transforming education again.* New York: Teachers College Press.

Cuban, L. (2001) *Oversold and underused: Computers in the classroom.* Cambridge MA: Harvard University Press.

Gee, J. P. (2003) *What video games have to teach us about learning and literacy.* New York: Palgrave Macmillan.

Maeroff, G. I. (2003) *A classroom of one: How online learning is changing our schools and colleges.* New York: Palgrave Macmillan.

Squire, K.D. (2004). Sid Meier's Civilization III. *Simulations and Gaming, 35*(1), 135-140.

Wenger, E. (1998) *Communities of practice: Learning, meaning, and identity.* New York: Cambridge University Press.