



NEW LEARNING ENVIRONMENTS IN THE 21ST CENTURY

Exploring the Edge

As the pace of change in the 21st century continues to increase, the world is becoming more interconnected and complex, and the knowledge economy is craving more innovation. In this environment, it is critical that we shift our focus from education to lifelong learning. Fortunately, the increasing availability of learning resources on the Internet is coinciding with the growing importance of continuous learning. John Seely Brown, visiting scholar at the University of Southern California and former chief scientist of Xerox Corporation and the director of its Palo Alto Research Center (PARC), believes that if we are willing to view learning from a new perspective we will no longer be resource constrained. He describes today's learning context that we must work within, and new learning models and forms of scholarship already under way. Brown outlines his vision of a new learningscape—one that is adapted to both the need for lifelong learning and our world of accelerating change.



MISSION CONTROL

- ✘ It is likely that the problems of the future won't be addressed by any one specialty; rather, cross-disciplinary approaches that encompass multiple areas of expertise and ways of knowing will have to become the norm.
- ✘ Might we reconceptualize parts of our education system and at the same time find ways to reinforce learning outside formal schooling so that the challenges of the 21st century can be met in a cost-effective way?
- ✘ The crucial difference between traditional classrooms and studios lies in the distinction between "learning about" and "learning to be."
- ✘ The Internet is facilitating the rise of pro-amateurs, which in turn is providing a new kind of learning platform ideally suited for the task of learning to be. For example, several hundred thousand Yahoo! Groups dedicated to specific communities of interest exist today.
- ✘ Imagine a hybrid model of learning—one that combines the power of passion-based participation in niche communities of practice with a limited core curriculum for teaching the rigorous thinking and argumentation specific to that field.



A New Context for Learning

Perhaps most salient to any discussion about learning in the 21st century is the fact that today's students are growing up digital. They have a new vernacular—a digital, multimedia vernacular—and learn in ways that are different from how I learn and, I would guess, how you learn. How can we begin to take advantage of those differences and unleash in our students a passion to learn and create?

A second characteristic of the new learning context, ironically, is that now, when education is more important than ever, much of the American public seems less willing to pay for it. Given that constraint, we need to find ways to tap the naturally occurring curiosity of our students so that we can turn them loose to do more learning on their own.

Third, we need to keep in mind that today's students will not have fixed, single careers. Instead, they are likely to follow a working trajectory that encompasses multiple careers—and as they progress, they won't be able to depend on what they learned in school a decade earlier. They will need to be able to gain new skills outside today's traditional educational institutions.

Fourth, from a larger perspective, it is likely that the problems of the future won't be addressed by any one specialty; rather, cross-disciplinary approaches that encompass multiple areas of expertise and ways of knowing will have to become the norm. People will need to be able to work in such cross-disciplinary teams.

The fifth key characteristic of learning in the 21st century is the truly global nature of our economy. Today's students will both compete against and, ideally, cooperate with people from around the world to build and shape the global economy. How the United States fares in this situation will depend to a large extent upon how well we can educate our citizens.

Finally, one of the greatest challenges we face is how to encourage our institutions of higher learning to become learning institutions themselves. Some for-profit institutions, such as the University of Phoenix, are doing this quite well. Perhaps the not-for-profit institutions can learn some practices from them.



New Learning Models

Might there be a way to reconceptualize parts of our education system and at the same time find ways to reinforce learning outside formal schooling so that these challenges can be met in a cost-effective way?

Architects' studio-based training offers a successful model of learning that may be more broadly applied. In an

architecture studio, all work in progress is public and so students can see what every other student is doing. Students witness the thinking processes other students use to develop their designs. Particularly via the practice of the public critique of projects, students gain a moderately nuanced understanding of the design choices, the constraints, the unintended consequences of choices made early on, and the compromises that may underlie the final product. They start to appreciate and learn from the struggles and successes of their peers, and learn the social and intellectual practices that enable them as an ensemble to become a reflective practicum. Indeed, the students are beginning to be enculturated into the practice of being architects.

Studio-based learning can work for other subjects too. The Technology Enabled Active Learning (TEAL) project at the Massachusetts Institute of Technology (MIT), based on earlier efforts at Rochester Polytechnic Institute, began as a studio for learning about electricity and magnetism (E&M)—a largely theoretical and difficult subject that historically had a high rate of student failure at MIT. The E&M studio consists of 13 tables with nine students per table. Most of the student work involves building, running, and experimenting with simulation models pertinent to E&M and then solving problems. No traditional lecturing takes place. Some recitation does occur, but mostly the professor and teaching assistants walk around from table to table, see what interesting issues are unfolding, and occasionally interrupt the entire studio to discuss something that a particular table is encountering. After the assessment and refinement of teaching practices to reflect the transition from sages on stage to mentors in the studio, the course became a tremendous success—so much so that the TEAL studio model has been extended to all first-year physics classes at MIT.

I believe that the crucial difference between traditional classrooms and studios lies in the distinction between “learning about” and “learning to be.” Lecturing can be a very effective way to communicate information *about* physics, for example, but bridging the gap between knowledge and knowing entails learning by doing and joining a community of practice. Typically, it's not until well into graduate school that a student begins to be enculturated into a particular field. We need to find ways that allow students to learn more about learning to be, far earlier in their education. Today's students want to learn and create at the same time, and pull content into use immediately. That content needs to be situated and actionable—both important aspects of learning to be.

One of the greatest challenges we face is how to encourage our institutions of higher learning to become learning institutions themselves.



Pro-Amateurs

The Internet is facilitating the rise of pro-amateurs, which in turn is providing a new kind of learning platform ideally suited for the task of learning to be. The term “amateur” in today’s culture tends to be heard negatively. But the etymology of “amateur” comes from the Latin word *amator*, suggesting something you do for the love of it. Professionals do something for pay; amateurs do something out of their passion or love for it.

Much of modern science got started by amateurs who circulated letters to their fellow amateur colleagues, thereby supporting their own niche community of interest. Eventually, these letter writers organized themselves into the Royal Society and circulated their letters in *Philosophical Transactions*, the first scientific journal in the English language. Early issues of the journal, comprised of collections of serendipitous observations, read quite like list postings and blog entries. Blogging practices today—especially those of graduate students—are giving new rise to the pro-amateur classes in many cross-disciplinary scientific endeavors. Social software such as Yahoo! Groups and bulletin board systems (BBSs) are reifying these niche communities of interest and helping others find and join them—no matter how specialized they are. These amateur groups never have had much access to powerful tools, but today they are beginning to gain access to remote instruments and computational resources.

Pro-amateur astronomy may be the best realm to illustrate the rich interplay of all these dimensions. Today, multiple telescopes in different locations simultaneously capture and transmit images over the Net, thus allowing triangulation to occur. But the real power of the Net is as a social, learning milieu. The members of each local pro-am astronomy group can use the Net to post images and discuss what they are seeing. They can swap techniques and plan joint distributed experiments. Most importantly, they can start to interact with professional astronomers. One might wonder why professionals would be willing to spend their time talking to pro-ams. There are two reasons: First, the serious amateur often has perfected the practice of looking. Seeing faint objects in a telescope is not automatic and, in fact, not that many professional astronomers have developed that practice. Their specialty is usually more on the theory side. Second, the network of pro-amateur astronomers covers the globe, yet all are interconnected via the Net. This means that the sky is being watched in both hemispheres on a 24/7 basis. When a nebula flares, for example, it is often a pro-am ideally positioned somewhere in the world who first sees it.

Clearly, a synergistic interaction between the profession-

al and the pro-amateur is developing in the field of astronomy. Both are helping each other; the whole is more than the sum of the parts. And through these interactions the pro-amateur is becoming a legitimate peripheral participant in the professional practice of astronomy writ large. A learning culture is being created that is mutually beneficial to both.

Astronomy offers but one example of this phenomenon. While it is difficult to determine just how many different pro-am groups exist today, one can produce an estimate based on the number of Yahoo! Groups dedicated to specific communities of interest. These number in the several hundred thousands. For example, there is a very active Yahoo! Group for amateur racing of Porsche 911s that discusses all sorts of arcane bits of knowledge on enhancing the performance of the 911.

Another space of activities on the Net where the interaction between amateurs and professionals provides a limited form of cognitive apprenticeship is Wikipedia. Many of the entries on Wikipedia first get sketched out by dedicated amateurs—pro-ams—in a field. Eventually the entries thus created catch the attention of professionals, who often start to rewrite parts of the entry. These changes, of course, are also subject to replacement by other professionals or amateurs. The entire process of additions and rollbacks is subject to public scrutiny and thus provides a glimpse into the thinking processes and scholarly practices of the field. The interested “student” can thus become a peripheral participant in this scholarly endeavor.



New Forms of Scholarship

The Decameron Web site hosted by Brown University is an interesting example of a new form of scholarship and scholarly publication. This site—recently expanded into the Virtual Humanities Lab—is comprised of scholarly work focused on Boccaccio’s *Decameron*, an Italian classic written in the 14th century. Decameron Web is the authoritative site on the *Decameron*; scholars from around the world are invited to contribute to it. The site might be thought of as a living document, a platform to which new material is constantly being added and critiqued. What is particularly interesting about this new type of document is how it becomes a learning-to-be platform, where both graduates and undergraduates can experience scholarship as it unfolds. Students start out participating on the periphery by helping to do and critique semantic translations of phrases. But most importantly, they begin to see how scholars respond to each other. Eventually, some also put their own writings up and see how other scholars respond.

One cannot travel down this path very far before the question of tenure arises. Sites such as the Decameron Web have their own form of peer review—often more a form of post- rather than pre-publication peer review. Is publishing here less or more important than publishing in traditional journals? Or, is it less or more useful to progress in that field? What counts as a publication? What counts as peer review—a year's worth of commentary that the article engendered? Do citations in this medium count the same as in print journals? And so on. Regardless, these sites—of which there are hundreds—also serve in a curious way as a form of cognitive apprenticeship. Might this form of scholarship lead to a more cost-effective way to teach specialties—one that many universities could contribute to either as hosts or participants?

A Grand Transition?

In the 20th century, education focused on “learning about” and building stocks of knowledge and some cognitive skills in the student, to be deployed later in appropriate situations. This approach worked well in a relatively stable, slowly changing world where students could expect to learn one set of skills and use them throughout their lives. Careers often lasted a lifetime. But the 21st century is quite different. Skills learned today are apt to be out-of-date all too soon. The concept of lifelong learning—a term used all too glibly—is now more important than ever. When technical jobs change, we can no longer expect to send a person back to school to be retrained or to learn a new profession. By the time that happens, the domain of inquiry is likely to have morphed yet again.

A different approach is called for—one characterized by a demand-pull rather than the traditional supply-push mode of building up an inventory of knowledge in students' heads. The shift from a supply-push to a demand-pull basis of learning is a grand transition. The focus shifts from building up stocks of knowledge (learning about) to enabling participation in flows of action, where the focus is on both learning to be through enculturation into a practice and on collateral learning.

This mode of learning is closely aligned with Dewey's constructivism, but it is also somewhat different, for two reasons: First, the demand-pull approach is a combination of the cognitivist and the social constructions of understanding. Second, and perhaps more importantly, it presents an approach to lifelong learning that is now dramatically enabled by the Net. The demand-pull approach embeds students in a rich (sometimes virtual) learning

community built around a practice. It is passion-based learning, as students are intrinsically motivated by either wanting to become a member of a particular community of practice or by just wanting to learn about, make, or perform something. Often the learning that transpires is informal rather than formally conducted in a structured setting. Learning occurs in part through a form of a reflective practicum; in this case, though, the reflection comes from being embedded in a social milieu supported by both a physical and a virtual presence, and by both the amateur and the professional practitioner.

Conclusion

I suggest that we are now presented with a fundamentally new possibility for 21st-century learningscapes. Imagine a hybrid model of learning—one that combines the power of passion-based participation in niche communities of practice with a limited core curriculum for teaching the rigorous thinking and argumentation specific to that field. Designing such a curriculum would require an elegant minimalism. It is implicit in this new learningscape that, given the nearly infinite number of niche communities that exist on the Net, nearly any student of any age will find something that he or she is passionate about. For middle and high school students, finding and joining such communities could well happen outside formal schooling. In college, such communities most likely would be campus-based—whether on the student's own or another campus.

One would also expect a form of spiral learning to evolve, initially rooted in one community but then branching out to encompass expanding interests and skills. The spiral would weave a tapestry between activities in the niche communities of interest and the core curriculum, with both serving to ground and complement the other. This new learningscape would be supported by an understanding of the interplay between the cognitive and social bases of learning, and enabled by the networked state of the 21st century. Such an educational experience would undoubtedly build a strong foundation for lifelong learning in a world of accelerating change.

John Seely Brown is currently a visiting scholar at the University of Southern California. Prior to that, he was the chief scientist of Xerox Corporation and the director of its Palo Alto Research Center. His most recent book is *The Only Sustainable Edge* (2005), co-authored with John Hagel. Brown can be reached at jsb@johnseelybrown.com.