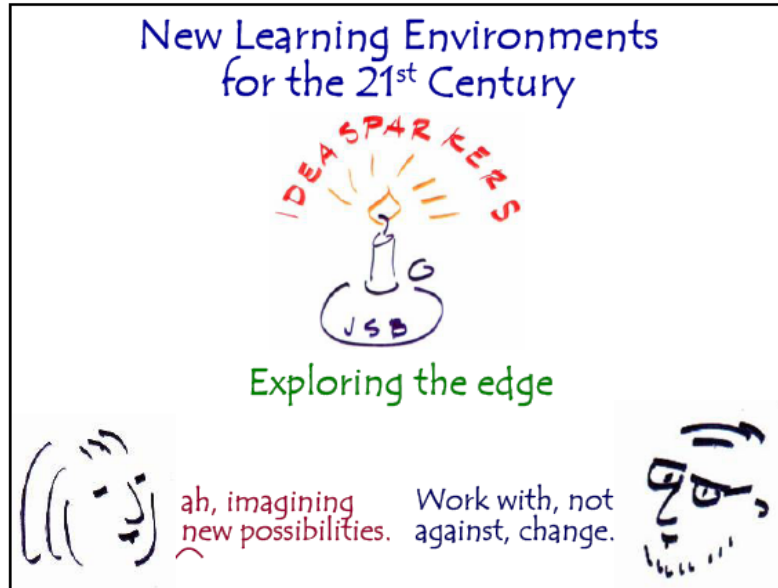


New Learning Environments for the 21st Century*

John Seely Brown



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 intellectual property. In this environment, it is critical that we shift our focus from education to life-long learning. Fortunately, the increasing availability of learning resources on the internet is coinciding with the growing importance of continuous learning. If we are willing to view learning from a new perspective, we are no longer resource constrained.

Opportunities to enhance learning by exploring the edge are presenting themselves as well. It is at the edge that most innovation occurs and where we can discern patterns that indicate new kinds of opportunities and challenges. In this context, the edge can mean many things: kids who grow up digital, second-tier and for-profit teaching institutions, developments in rapidly changing nations such as China and India, new kinds of institutional frameworks such as creative commons, open source, and Wikipedia, and new media forms. Each of these relates to another edge – the edge of the educational establishment.

Because I was brought up as a hard core technologist, I was surprised to find that some of the most innovative uses of technology occur on another edge – at least from my perspective- that is, in the humanities. Not the first place I would have looked, but I was wrong.

* This paper is based primarily on a presentation by the author at the Forum for the Future of Higher Education's 2005 Aspen Symposium and a shortened version of it is published on their website.

A New Context for Learning

Let's step back a moment and look at the context we all find ourselves in and the challenges we face. First, every one of us recognizes that today's kids, our students, are different from most of us here. They have a new vernacular - a digital vernacular. But today's students also learn in ways that are different from how we learn. How can we begin to take advantage of those differences?

Second, one of the most ironic situations is that although education is more important than ever today, the public—at least in my home state of California—seems less willing to pay for it than ever before. At a minimum we need to find ways to tap the naturally occurring curiosities of our students so that we can turn them loose to do more learning on their own.

Third, if we want to educate students for the 21st century, we must realize that most students today aren't going to have a fixed, single career; instead, they are most likely going to follow a working trajectory that encompasses multiple careers. As they move from career to career, much of what they will need to learn won't be what they learned in school a decade earlier. They will have to be able to pick up new skills outside of today's traditional educational institution.

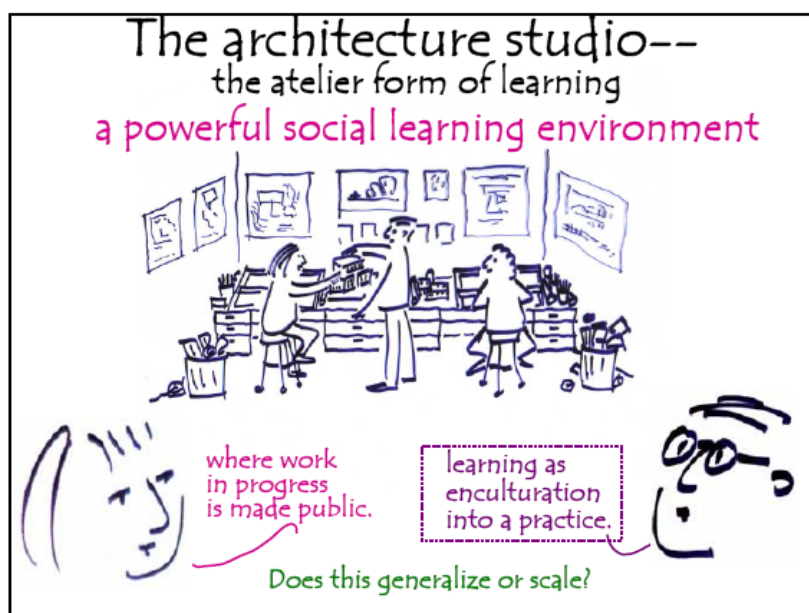
Fourth, since nearly all of the significant problems of tomorrow are likely to be systemic problems – problems that can't be addressed by any one specialty -- our students will need to feel comfortable working in cross disciplinary teams that encompass multiple ways of knowing.

Fifth, and finally, one of the big challenges we face is how to encourage institutions of higher learning to become learning institutions themselves. Some for-profit institutions, such as University of Phoenix, are doing this quite well. Perhaps we need to learn some practices from them.

As if these challenges are not enough, let us reflect on Tom Friedman's recent book, *The World is Flat*, or the book that John Hagel and I also wrote recently, *The Only Sustainable Edge*, in terms of the challenges we face in a truly global economy. In that regard, consider this astounding piece of data: In 2004, China and India graduated about 500,000 engineers and the United States graduated 90,000 engineers. Moreover, 40,000 of the graduating engineers in the U.S. returned home to India and China. The net is 550,000 engineers over there and 50,000 engineers over here. This is a year-over-year growth pattern. In just a few years, then, there will be millions of more technically educated people in China and India than in this country. Further, if you have a conversation with students in either India or China you can't help but be impressed with their passion to learn and the energy they bring to this pursuit. Let us hope we can find ways to unleash a similar level of passion in our students to learn, learn and learn.

New Learning Models

Might there be a way to re-conceptualize parts of our educational system and at the same time find ways to reinforce learning outside of formal schooling so that these challenges can be met in a cost effective way? Successful models of learning already in place offer ideas that may be more broadly applied. Let's start with the training of architects, done mostly in studios.



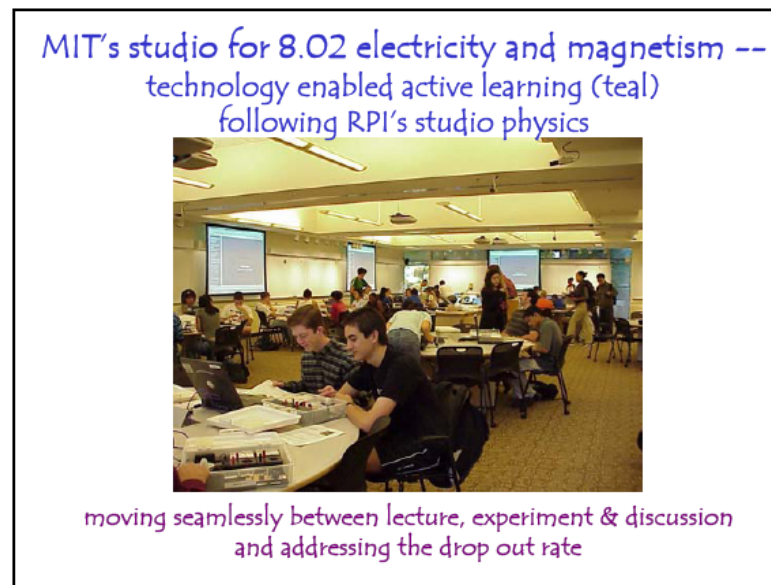
Note that in studio-based learning environments all work-in-progress is always made public. As a result, every student can see what every other student is doing. Moreover, every student witnesses the thinking processes that other students are using to develop their designs. And then there is the public “crit.” What typically happens is that the master and several outside practitioners come in and critique each of the student’s projects. The other students not only get to hear each other’s critiques, but because they were in some sense peripheral participants in the evolution of each other’s work, they understanding the thinking behind it. They have a moderately nuanced understanding of the design choices, the constraints, the unintended consequences of choices made early on, and the compromises that may underlay the final product. As a result, the brief crit holds substantial significance and presents learning opportunities for all the students – not just the one whose project is being critiqued.

Now compare the efficiency of the professor’s time in this situation with the time typically spent talking with students during office hours. Also consider how students in studios start to pick up skills from each other, i.e., how they witness the wide variety of ways to approach a design problem in the first place and how they start to appreciate and learn from the struggles, the missteps, and the successes of their peers, as well as how they start to learn the social and intellectual practices that enable them as an

ensemble to become a reflective practicum. Indeed, they are starting to be enculturated into the practice of being an architect. Learning as enculturation is a side of learning seldom discussed except by social learning theorists – a school of thought I will come back to.

You may be thinking, yes, but studios are studios. How many students are in a studio at any one time? How does this scale? If we can't actually figure out interesting teaching or learning innovations that scale, then forget it.

But studio-based learning can scale. Let me show you one more example - a very interesting example from the Massachusetts Institute of Technology (MIT).



This is the Technology Enabled Active Learning (TEAL) project at MIT. I believe this idea was borrowed from Rochester Polytechnic Institute and extended by Professor John Blecher at MIT. The particular stimulus that led Professor Belcher to construct a studio-based approach to physics stemmed from MIT's experience with its 8.02 Electricity and Magnetism (E&M) course. This course used to be a wonderful course for convincing most students who thought they wanted to become physicists or engineers that the grass may be greener elsewhere. The attrition rate was very high; the attendance rate was low. In other words, this course was a buster.

So Professor Belcher set out to build a studio for learning electricity and magnetism – a bold move considering how theoretical this subject matter tends to be. It is not a field that lends itself to intuitive causal or mental models. Instead, it is a subject that traffics in field equations expressed as partial differential equations.

And so MIT built a new kind of classroom for studio based learning of E&M. The classroom 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. Yes, a small amount of

recitation goes on, 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.

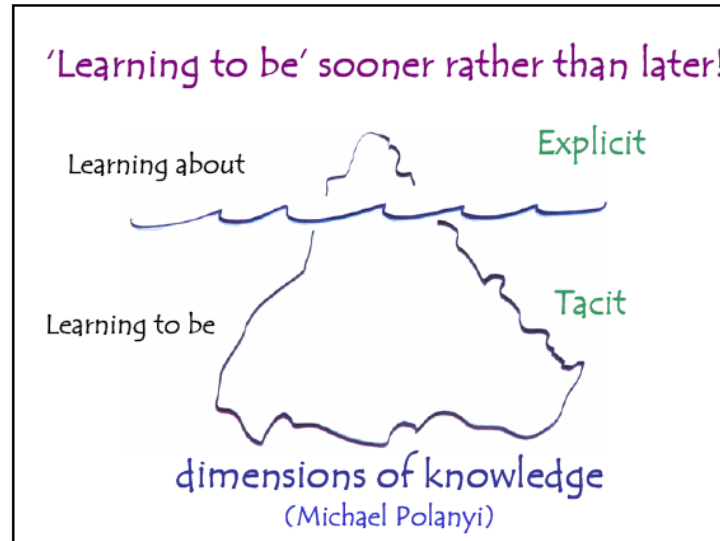
To many of us, this seemed like a wonderful idea. It worked fairly well, but not as well as Belcher had hoped. So after the second year, Belcher and his team decided to step back and reflect on what was really going on. They began to realize that while they were all skilled at lecturing to 800 people in massive lecture halls, perhaps the practices that worked so well in the lecture hall were counter-productive for a studio-based learning environment. Maybe new teaching practices tuned to this new kind of learning environment were needed. Toward this end, Belcher and his team held a summer workshop to help make the transition from sages on stage to mentors in the studio. They asked, “How do you actually do activity-based learning rather than lecturing?” A new set of practices started to emerge from the workshop. The course was then rebooted using and perfecting these new practices, which in turn led to the course being a tremendous success. Because of its success, the TEAL based studio has now been extended to all freshman physics classes at MIT.

The moral of this story is that you can’t just drop new innovations into a classroom and hope that the instructor will invent effective ways to use them. To fully utilize a new teaching technology you often need to invent new teaching practices as well. And to do that you need to have the desire, freedom and time to experiment with and refine these new practices. Old practices don’t die easily, nor do new ones easily rise in their place. Indeed, this is why I question many of the studies on the effectiveness of new technology for enhancing education. These studies seldom address the evolution of appropriate new teaching practices for bringing forth the real potential of the new technology. Technology by itself is seldom, if ever, the solution.

After hanging around architecture studios now for several decades – my wife is a practicing architect – I began to understand that what’s really happening there revolves around the difference between ‘learning about’ and ‘learning to be’ – a crucial distinction. Lecturing can be a very effective way for communicating information ‘about,’ say, physics, but it often is not until their second year in graduate school that students enter more of an apprenticeship, research phase and begin to learn what it means ‘to be’ a physicist - or a mathematician, or a humanist, and so on.

Learning-to-Be

There is a crucial difference between learning-to-be and learning-about. For me, it wasn’t until my



second year in graduate school in mathematics at the University of Michigan, taking a course from Professor Paul Halmos, that I got a glimpse of what it meant to be a mathematician. Someone in our class asked him a question that he couldn't immediately answer. What followed was amazing. All of us in the classroom had the chance to watch him struggling with the question for over half an hour. Halmos was doing mathematical research; he was exhibiting the practices of being a mathematician. I had spent six years studying theoretical mathematics and had never had the slightest glimpse of what it might mean to be a practicing research mathematician. That one moment in time gave me an insight into the practice of being a research mathematician. I was spellbound.

We need to find ways that our students can learn more about learning-to-be much earlier in their education. Today's students want to create and learn at the same time. They want to pull content into use immediately. They want it situated and actionable - all aspects of learning-to-be, which is also an identity-forming activity. This path bridges the gap between knowledge and knowing.

Learning to be – in an epistemic frame

Enculturating into the practices of a field often via
legitimate peripheral participation - apprenticeship

a way of seeing

a way of knowing

sensing what constitutes an interesting problem

knowing what constitutes an elegant solution

being able to engage in productive inquiry

*Productive inquiry is that aspect of any activity
where we are deliberately (though not always
consciously) seeking what we need, in order to do
what we want to do – e.g. leveraging the net.*

(productive inquiry also as active leisure)

The ‘learning-to-be’ distinction has much lot to do with situated cognition and more generally Jean Lave’s situated learning theory (1991). Lave’s theory focuses on learning as enculturation into a practice, often through the process of legitimate peripheral participation (LPP) in a laboratory, a studio, or a workplace setting. Although this term is often thought of as equivalent to apprenticeship learning, it is more general than that. Apprenticeship learning is designed explicitly to learn a practice under a master who, if he or she is good, has carefully meted out a set of increasingly challenging activities to be performed. The spirit of LPP is that students are legitimately engaged in real work, fully participating in the technical and social interchanges and almost through osmosis are picking up not only the practice, but also the set of sensibilities, beliefs and idiosyncrasies of this particular community (of practice). Learning and joining this community simply go hand-in-hand; learning happens seamlessly as part of the enculturation process. Indeed, learning and joining become inseparable as students move from being peripheral members to being more central members of a community of practice. Needless to say, each community of practice is itself embedded in a broader epistemic frame, which suggests what problems are considered interesting problems, what constitutes an elegant solution, what warrants are acceptable in an argument, and so on. There are never explicit rules or predicates that define an epistemic frame, but being in a community of practice allows students to start to intuit and embody them.

Underlying all this is Dewey’s notion of being able to engage in productive inquiry. Dewey defines productive inquiry as that aspect of any activity where we are deliberately seeking what we need in order to do what we want to do. (Dewey, 1922 and Cook and Brown, 1999) In the net age we now have at our disposal tools and resources for engaging in productive inquiry – and learning – that we never had before.



How does all this relate to typical classroom learning? How much ‘learning-to-be’ can actually happen in a classroom? Answering this question might provide some sense of scaling possibilities. Consider the above photograph of a relatively typical MIT class session. What we see here is that every student has a laptop with the potential of IMing

each other, surfing the web, and Googling what the professor is saying. Of course, this is all happening while the professor is teaching. In such situations, the professor has two basic alternatives: One is to become a comedian and try to compete against the seduction of the internet for the student's attention. But most professors aren't great comedians and showman, especially while they are trying to teach.


The other alternative is to become more of a Socratic challenger. Suppose, for example, you're in a classroom just like this, and a student raises his hand and says "But professor, I just found this world famous scientist who says the opposite of what you just claimed," or "I just found the following fact that contradicts what you just said," or even worse, "I just looked up what you said two years ago and your story then was quite different than now. What's up? What should I believe?"

Indeed, the first time this happened to me my first reaction was defensive, to put it mildly. At this moment you could stare the student down, you could ignore him, or you could turn this moment into a critical, Socratic learning event. How? By seizing the moment, abandoning your prepared lecture and asking the student, or better yet, asking the entire class, "Why would you believe that – just because you found it on the net? I certainly hope not. Let's all search the web right now and see how many counter examples can be found for each position. Usually the class will go off and find a host of contradictory facts, opinions or arguments. So now the question becomes, how do you decide what to believe? What are the warrants for each belief? Are the warrants (or sources) really independent or do they just look independent? How rigorously can the warrants be defended? Soon the class is engaged in deliberate inquiry, critical thinking, and argumentation. Your job becomes that of a stimulator, moderator, guide and mentor – all on the fly. And students now see you demonstrating your practice, and thus they experience a small fragment of an epistemic culture. In other words, your students witness an act of knowing rather than just the rendering of knowledge.

Notice what has just happened. A problem stemming from the internet has been turned into an asset, a platform for practicing judgment in a particular context. This also involves the more general practice of making a judgment, which is the very basis of democracy--especially in the age of blogs, talk shows, and news channels that spout steady streams of opinions.

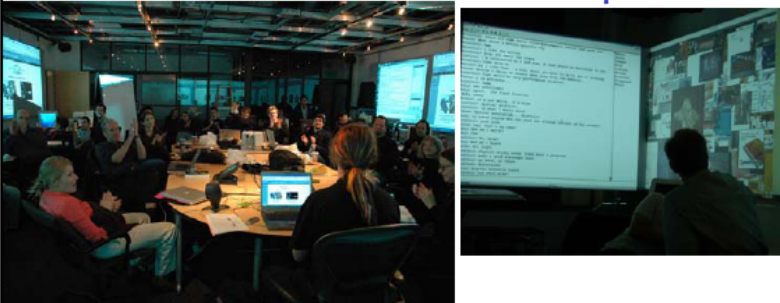
– the Clicker –
a simple technology that works



 Yeah but remember – new teaching practices must be invented and experimented with!!

Let's dwell for a moment on an elegant and simpler example – clickers and how they can be used in large classes. A clicker is a simple inexpensive device that can be distributed to every student in a class, enabling them to respond to questions posed by a teacher and immediately tally results. Here, the skilled practitioner can seize on some situation where the class has a moderate multimodal distribution of opinions around some issue. Much as in the previous example, the stage is set to support and deepen engagement and articulation as students try to mount arguments for their position. Note, however, that although this technology is beautifully simple, its potential is realized only when it is coupled to new teaching practices.

a digitally enhanced collaboratory
with back channels rendered public.



 Pretty weird, jsb. Now the professor or speaker has little or no control. Or does she?

USC — interactive media division

One more example of a new learning model will suffice. The slide above shows an experimental seminar room in the Interactive Media Division at the University of Southern California (USC). It has 27 full-size screens surrounding most of the room; each screen is independently controllable. Any student can grab any screen and can put

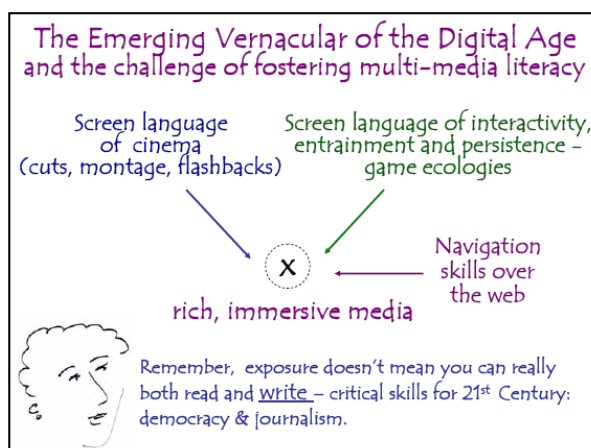
anything up on that screen. During a seminar, for example, they can Google and instantly project what they find of interest to the overall discussion. Just throwing something up on a screen is a new form of interjection. Nothing need be said, but in this kind of room, anything projected may eventually catch the attention of another person, who may elaborate on it and, if so, it in turn may be picked up by others in the room and be carried further.

If you use this room, you implicitly agree to render any back-channeling (e.g. IMing) onto one of the front screens. And finally, adjacent to the backchannel screen another screen is used to render in real time a collage of images being pulled in by anyone surfing the web during the seminar. The fact that all can see the collage does provide a bit of a social constraint on what gets surfed, but it also serves as an evocative set of images.

All this culminates in an immersive, collaborative experience where multiple images are being displayed of what students found interesting, what examples seem to hold everyone's attention, and a running commentary on what the seminar speaker is saying. For today's students, who are used to multiple windows being opened on their desktops and multiple things happening simultaneously, this space seems second nature. This experience is not for everyone though. It takes some getting used to. It also takes some trust and some radically different speaking and seminar practices to make this room come alive with productive inquiry.

We all have been in meetings where everyone is both listening and back-channeling. In most of the ones I'm in, there is a lot of peer back-channeling going on. When all that back channeling is put on the screen, something interesting happens and the class is transformed. As the seminar leader, you have an amazing window into how the students are hearing you, and how much they understand of what you are saying. You have a miniature window into their heads.

Granted, this seems a bit strange and it is easy to criticize and even mock. But remember, it is an experiment for kids who are inherently digital. Speaking from experience in the room, I can tell you that students' level of energy is high and the level of argument intense.



Multimedia Literacy

The issue of multimedia literacy and some of the new emerging vernaculars of the digital age connect to the concept of learning-to-be, in this case, learning-to-be literate.

What are the new vernaculars that kids growing up digital actually have? Our guess is that they are compositions of the screen languages that come from film, such as how cuts function, how montages create emotional tension, how flashbacks and nonlinear narratives can fold onto a linear timeline and the screen language of interactivity. The language of interactivity is seen most clearly in the gaming world, where the issues of entrainment and flow loom large. Likewise, we see the emergence of new genres around non-linear narratives, and persistent worlds that underlie the massive multiplayer role playing games. But what actually are these new genres? How are they to be “read?” How are they negotiated in practice now--not so much between reader and writer but between player and designer, and in what way does the community itself become a co-designer? Finally, in the same way that text has a social life around its edge, what is the social life around the edges of the game world really like?

In addition to the screen languages of film and interactivity, we must also consider the skill of navigation. Digitally literate kids often develop a knack for intuitively finding things on the web that many of us labor to find – a skill that serves them well in the context of productive inquiry and facilitates rapid explorations of the vast resources of the web.

These components come together to enable rich immersive, interactive genres that can be extremely expressive. And here is the catch: to be literate today means that you can not only read but also that you can write. Today’s digital youth can read in these new media, but can they write in them? And if so, how well can they express complex thoughts and emotions? As the director George Lucas succinctly put it to Elizabeth Daley, dean of USC’s School of Cinema and Television: In the 21st century can you honestly tell me that it’s not as important for these students to know as much about Hitchcock as they do about Hemingway?

Lucas’s own words elaborate on this idea well: “. . . I began to realize the potential for multimedia to enhance the learning process was just astronomical . . . I’m a big proponent of a new kind of grammar that goes beyond words. To tell a story now means grasping a new kind of language, which includes understanding how graphics, color, lines, music and words combine to convey meaning.”


**Evolving forms of literacy –
the USC multimedia literacy program**

- > the structure of visual arguments
- > the ability to communicate using
image, text, sound, movement,
sequence and interactivity in combination

English, philosophy, women's studies, history
sociology, political science, religion
and quantum mechanics

are new forms of scholarship
being enabled?

professorial workshop is critical



Elizabeth Daley (and now USC more generally) took on Lucas's challenge and in 1996 created the Institute of Multimedia Literacy (IML) to experiment with how to provide both students and faculty the chance to develop these new literacy skills. The purpose of this program is not to teach students about the tools of multimedia, but rather to focus on new expressive practices enabled by these tools—for example, how do you make a compelling visual argument? We all know how to make arguments in text, but how do you actually make an argument visually? More generally, how do you communicate effectively using image, text, sound, movement, sequence, and interactivity all in combination? Needless to say, such skills are more important today than ever before, given that capturing and holding people's attention is becoming increasingly challenging.

The IML program has touched nearly every department at USC. Some of the more actively engaged disciplines are women's studies, political science and religion, but other disciplines are involved as well—including a course in quantum mechanics. Its success is due, in part, to a two-week summer workshop that professors who want to be a part of the program must take. Similar to MIT's studio-based learning efforts, it was of critical importance that the USC professors and their teaching assistants experiment ahead of time with the medium and discover what is easy and what is hard to do. Some first-hand experience is crucial, since a key part of using IML in a course is that the students must "write" their final papers in multimedia and publicly present them.

Another important aspect of the IML workshop is that the faculty bring the curriculum for their courses and engage in something akin to story boarding their essential ideas and flow of their courses to get a sense of what kinds of multimedia assignments make sense and how to stage them. Reflecting on the curriculum from this point of view leads to some provocative but collaborative discussions among the faculty in the workshop.

New forms of scholarship

Publishing as a living document - website

New ways for students to engage in research

New forms of peer review

What will this mean for tenure?

Vectors - a pioneering e-journal (IML-USC)



Brown Univ.

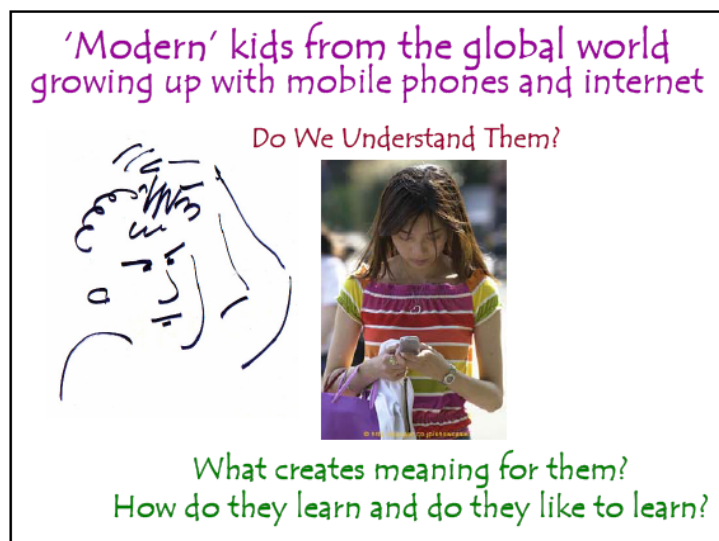
New Forms of Scholarship

The Decameron Web site at Brown University is an interesting example of a new form of scholarship and scholarly publication. This website is comprised of scholarly work focused on Boccaccio's Decameron, an Italian classic written in the 14th century. Decameron Web (and especially its expanded version called the Virtual Humanities Lab) is the authoritative site on 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 graduate and undergraduates can experience scholarship as it unfolds. Students start out by participating on the periphery helping to structure, critique and comment on the writings. 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.

I expect what we see here is just the tip of the iceberg of not just new forms of scholarly journals, but also sites that focus on a specific subfield that allow specialists to create an international resource for themselves and their students. Eventually we may well find that each university will start to specialize in a particular niche or scholarly endeavor and will take responsibility for stewarding a site that provides a place for scholars in that field to collaborate in cyberspace.

Of course one cannot travel down this path very far before the question of tenure arises. Such sites have their own form of peer review – often more of a form of post- rather than pre – peer review. Is publishing here less or more important than in 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, in a curious way, sites such as Decameron Web also serve 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 contribute to either as hosts or participants?



Growing Up Digital

What is going on with kids who are growing up digital? How do they learn? How do they like to learn? How do they problem solve? And most importantly, what creates meaning for them and helps them to construct their own sense of self? To probe some of these questions we must look beyond the United States to parts of Asia, such as Korea, which for many years have been significantly more digital than the United States has been. There we can begin to get a glimpse of the new kinds of social, work and learning practices—as well as forms of entertainment/infotainment—that emerge when a country or a generation is immersed in a digital milieu. In Korea, for example, very little time is spent reading newspapers and watching TV. Life moves to the net. And we are not just talking about kids.

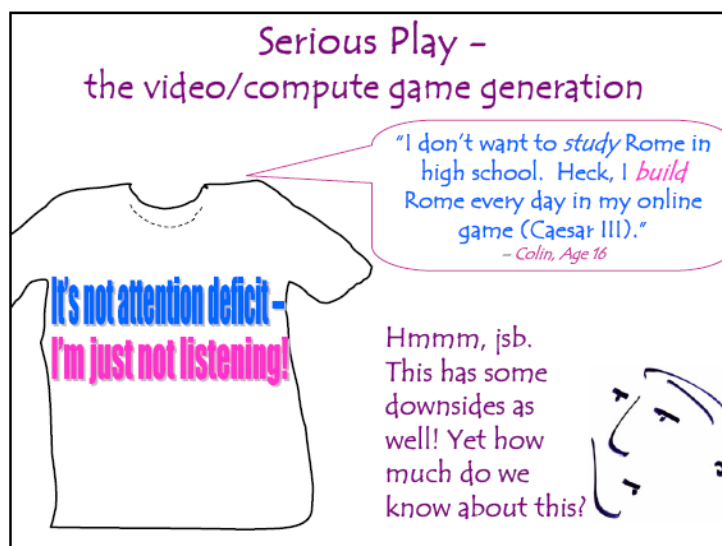
One of the first things one notices in Asia is that carrying a laptop does not make you look particularly digital. Laptops are viewed more as a kind of dinosauric technology. It's the modern, intelligent, multimedia mobile internet device that defines being digital. These devices used to be cell phones, but phone calls are a small part of what they are used for today. Sure the screens are bad, but not terribly so. Small screens have certain advantages too. A Japanese teenager is apt to have very little privacy at home. As a consequence they actually like using small screens: A small screen helps to create a sense of private space and others can't easily see what they are doing unless explicitly invited to do so. It is also interesting to see how they integrate texting (SMSing) with actual calling – text first to see if the coast is clear, i.e. if any parents are within earshot. We can see social protocols emerging. For example, since talking on cell phones on a public bus in Japan is frowned upon, people tend to text someone to see if they are now in a place where they can talk.

As we have learned from Dr. Mimi Ito – a cultural anthropologist studying youth cultures in Asia and the United States, texting and instant messaging (IM) creates a sense of presence. Folks can feel that they are always able to reach out and touch one another in their own intimate community or buddy group. Now add the digital camera on their mobile device (not even called a cell phone in Japan) and they can share a momentary experience with their intimate community. In other words, not only does mobile multimedia communication enhance a sense of continuously being with others, but it also enhances a sense of intimacy, particularly when people are always on the go or spending large amounts of time on public transportation.

Game-Based Learning

The first thing to realize about game play is that most video games are incredibly difficult to master. If you're not extremely good at pattern recognition, sense-making in confusing environments, and multitasking, and if you are afraid to constantly explore and push the limits of what you do, then you won't do well in the game world. In this world, you immerse yourself in an immensely complex, information rich, dynamic realm where you must sense, infer, decide and act quickly. When you fail, you must learn from that failure and try again and again and again. Continuous decision-making under uncertainty is the coin of the day.

In addition, the gaming generation turns out to be very bottom-line oriented. They want metrics and they want their performance measured. They want to learn, and without measurements they can't tell if and how much they are learning. Surprising as it may sound, many gamers say, "If I'm not learning then it isn't fun!" This also means that game designers must know how to design good learning environments; environments that are constantly throwing new challenges at the player that are neither too difficult nor too simple. Further, as the player improves, the challenges need to be more demanding--but at just the right pace. The more I study game play, the more I think about the term "serious play."



Let me tell you a bit of a story about a 16-year old boy named Colin. His dad was trying to convince him to take his history lessons about Rome more seriously. Colin's knee-jerk reaction was "I don't want to study Rome. Heck, I build Rome every day in my online game." Now me, I would have felt like screaming at this arrogance. But wait, let's listen in to the dinner conversation later that day. During dinner, Colin and his dad started talking about the tricky topic of class in our society. About halfway through the conversation the dad stops and asks Colin, what does class mean to you? And Colin thought for a moment and said, you know, in Rome, your class was reflected by how close you actually lived to the Senate (which is only somewhat true). I think today in the United States it probably reflects how close you are to a Senator. Not a bad answer. Clearly Colin is forming some kind of model of the social dynamics in both Rome and today. At a minimum, he is engaging in pattern recognition and sense-making and is willing to apply those patterns to novel situations or questions.



One of the most popular mass multiplayer online role playing games in the world is World of Warcraft. It first caught my attention in Beijing, where the morning it was released as a beta there, 150,000 kids lined up outside to get it. There are now over 4.5 million players in this mass multiplayer role playing game and the game is just a year old. Although I could talk for hours about many aspects of this game, I want to focus on how a player can build a guild. Guild building is important since nearly all of the quests that players have to perform to become more powerful and to build up rank (remember in games, everything is measured) require others to join in to assist in the quest. Quests are complex, demand careful planning and training, and require amazing skill among the players, who assume diverse roles. A high level quest can't be carried out by just warriors, for example; healers and spell casters are also needed and all these folks must function as a well-organized and practiced team, or a complex quest will never be successful. To succeed, therefore, one must build a guild or join one. To build a guild you must be able to attract, train and retain other players to be part of your guild. Of course, most players are just guild members and can only aspire to become guild leaders.

I have now had the chance to study several of the best guild masters in the World of Warcraft and to explore the necessary leadership skills of guild leaders. Here's a list of skills compiled by Stephen Gillett, one of the players I have interviewed and watched: First, a guild leader must create a vision and a set of values that attracts other players. Second, the leader must find, evaluate and recruit players that have a diverse set of skills that fit with his or her value space. Next the leader has to create an apprenticeship program for training newbies quickly. And then the leader has to orchestrate group strategies for quests. But the biggest challenge is to keep the guild running. To do this the leader has to create, sell and adhere to the governing principles of the guild – to walk the talk – and to adjudicate disputes and find equitable ways to split up the spoils of any successful quest. Note that there can be as many as 40 people on any given quest. For such large quests, the leader may need to persuade another guild to join in.

Reflect a moment on this set of skills. Isn't it the same set of skills that the leader of a startup or even a CEO needs to have? These are also many of the skills required to create and lead a non-profit organization.

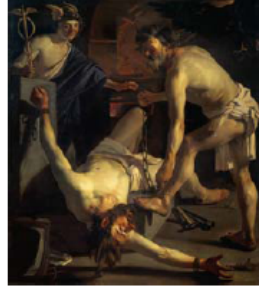
For reasons I don't quite understand, most folks who write about game play seldom talk about the social life around the edge of the game. Yet that's where most of the thinking, planning, trading of arcane knowledge bits and learning actually occurs. In Stephen's case, the skills he has acquired in guild building in World of Warcraft and in several prior games all happened around the edge of the game. That edge becomes a reflective practicum.

Stephen, as it turns out, is not a geek. He was a college football player, and a successful one at that, having played in the Cotton Bowl. And now at just 27 years old he has a senior management role in one of the largest internet companies in the San Francisco Bay area. He is comfortable in attributing his meteoric rise in management to the skills he learned in game play. Of course, one case hardly proves the rule, but the more I probe the more I believe that Stephen's story is not all that unique.

The game examples addressed thus far were not designed to be learning games. Yes, they were built around some excellent pedagogical principles, but those principles were used to create great game play. Skill building occurs in the game because that is what makes the game fun – getting better at tackling increasingly difficult challenges. The kind of learning that we find so provocative is the learning that both Colin and Stephen experienced – that is, learning that is collateral to the game play itself. Might it be possible to design games that enhance this secondary or accidental learning? This would not involve games designed to teach something explicitly (often called serious games or games built around simulations), but rather games where the by-product of playing results in developing a useful social, technical or managerial practice.

Massively Multiplayer Online Role Playing Games:
Constructivist Ecologies –

persistent, accretive, multi authored narrative



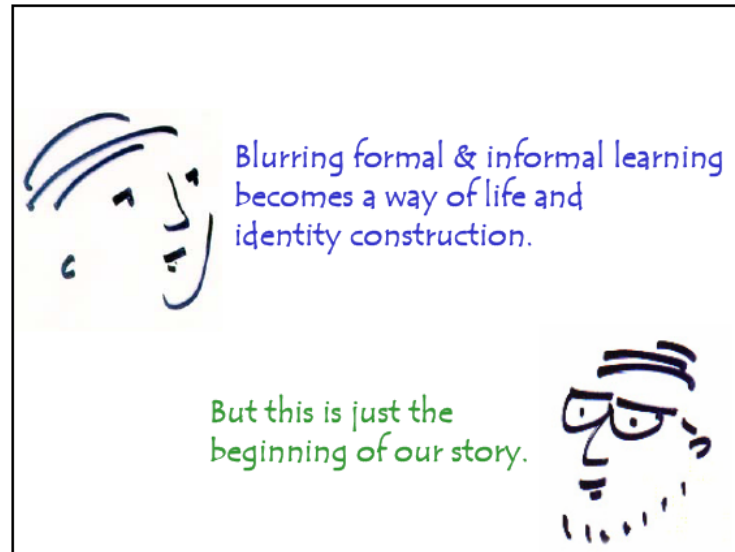
Modern Prometheus Project: modeling a portion of Shelley's novel
for a course in culture, history and ethics

Doug Thomas

My final example is a work in progress. It is a massively multiple player role playing game, much like World of Warcraft, being designed by Professor Doug Thomas at the Annenberg School of Communication at USC. But unlike World of Warcraft, this game is designed to be the classroom – that is, the class is held in the game space and is designed to have the students face ethical dilemmas that emerge as unintended consequences of the decisions they make in playing the game. It is called “Modern Prometheus” and is framed as a modern day, molecular genetics version of Mary Shelley’s novel *Frankenstein*.

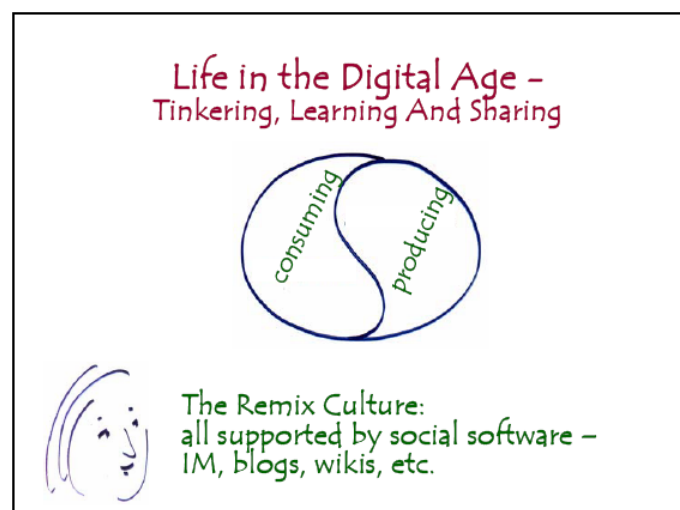
The goal of the project is to reframe ethical issues, particularly as they relate to science and technology, by having students make choices that have different results. Each decision they make will either open up or close off choices later in the game. By using ethical judgments as the basis of their choices and for assessing the effects of those choices (rather than prescriptive rules for conduct or behaviors), students can better understand the complexities of ethical judgment and better evaluate the choices they make. The game is designed for role reversibility, allowing students to experiment with different roles, decisions, and outcomes. Moreover, students will be able to play the game from several different points of view, allowing them to identify with different perspectives and understand how each set of ethical choices affects others and themselves in the game world.

David Williamson Shaffer, in *What Would a State of the Art Instructional Video Game Look Like?* (2005) discusses the potential of epistemic games as a new paradigm for learning....



The Social Life of Information

As the previous examples suggest, there may be powerful ways to blur the distinction between formal and informal learning, where both the formal and the informal turn on the social life of learning. I have written elsewhere, in *The Social Life of Information*, on the importance of the social construction of understanding – wherein experience and information are internalized into actionable knowledge through conversations and social negotiations. This epistemological stance is even more important for the kinds of informal learning discussed above. In the networked age, this approach might provide a way to both improve education and to set the stage for a culture of learning. We will come back to the issue of identity construction as well.



First, let's step back a moment and reflect on how many of us – especially guys of a certain age – grew up. We were constantly tinkering with all kinds of devices. We built radios and other electronic gadgets from kits and then we always had to repair or improve them. We tinkered with engines – first on lawnmowers then on motorcycles

and cars. We were constantly tinkering with our bicycles. In general, we simply grew up making and tinkering with things. Usually our parents thought this was wasted time. We should be home studying, not hanging around the local radio amateurs (called hams) and gas station garages, or in our own garages. Tinkering was seen by our parents and school administrators as wasted time—not something that a serious academically-oriented student would do. Yet many of us, now many years later, say that the tinkering we did growing up created the basis for much of what we learned in college or later in life.

But then the digital age came along and suddenly everything became cognitively impenetrable. Hacking modern cars is now somewhere between impossible and illegal. Repairing radios or TVs? Forget it. It is far easier to throw them away and buy new ones. But then the digital age gave way to the networked age and something happened. Tinkering communities self-organized around the net, forming distributed learning milieus. Consider again the gaming world. Gamers not only play games but seek out ways to improve or create modification (mods) to them. They pass these mods around the net and soon others pick up the thread and create their own mods or extend someone else's. Whole new games have been created from old games, and viral marketing has swept the old games away. Then still newer games explicitly designed to be built on to, and to let whole new worlds emerge came online, such as Sims Online.


Another change was happening at the same time: Games in the Sim genre attracted girls to the building and tinkering universe. These games are as much about sociality as about building, tinkering and playing. Players see what others do and ideas spread virally, online. Particular communities of interest formed, providing tinkering spaces to share ideas and dreams. These games eventually morphed even further into synthetic worlds such as Second Life, a space that attracts guys and girls equally, and that allows them to construct elaborate avatars and their own virtual worlds, where they actually own both the virtual real estate and the IP they create.

Tinkering, Learning and Sharing Galore

The Open Source Movements – Linux, ...

- ◇ writing code to be read
- ◇ engagement thru useful additions
- ◇ social capital matters

A form of apprenticeship
(cognitive apprenticeship)
apprenticing to a virtual
community of practice



open code, open system, open community discussion

100k projects, over one million folks engaged

Any discussion of building and tinkering in the networked age typically relies on examples from the various Open Source movements such as Linux, Apache, and so on. I will too, but from a slightly different angle than is usually taken. My focus will be on learning or, more precisely, the learning-to-be that emerges from joining and becoming

a full participant in a community of practice. Becoming a full-fledged member of a particular community of practice requires that you assimilate the sensibilities and ways of seeing the world embodied in that community. This is exactly what happens when someone joins an open source community.

But what are these sensibilities? Although each open source community has its unique constitution and work style, it is safe to say that nearly all of them have certain key practices in common. For example, code is to be written so that it can be read, improved and extended by others. Code must be robust and thoroughly tested by the creator before being submitted to the community. The joining process nearly always involves the neophyte writing and patching non-kernel code. By making enough contributions that are robust, useful, and done in the style of the community, participants' reputations expand and eventually they are allowed to make contributions to the kernel operating system code – a real achievement. At that point, they are recognized as key members of the community.

Note that what has been constructed here, largely as a by-product, is a vast learning platform that is, *de facto*, training thousands of people about good software practices. A powerful form of distributed cognitive apprenticeship that functions across the world has emerged. Today, there are about one million people engaged in open source projects, and nearly all are improving their practices by being part of these networked communities. The key to learning in these environments is that all contributions are subject to scrutiny, comment and improvement by others. There is social pressure to take the feedback from others seriously. Further, although there is no formal credentialing process, it certainly exists informally. One manifestation of being informally credentialed is to be asked to join the governing council of an open source community, or to oversee what code gets accepted and installed in the kernel of an open source system.

As someone who was formally trained in computer science many years ago, I must admit that the learning processes I went through felt quite different than what I have just described. In my own circle, for example, those of us who could would try to write clever code—code that was so mysteriously and compactly written such that very few others could figure it out made us look like heroes. Although we would often learn from each other, there were certainly no mechanisms that supported that learning, nor did we ever feel as if we were joining a learning community. The net has changed all this, and the institutional innovations that have enabled open source to flourish have transformed how many people learn-to-be computer professionals.

Blogs

- ◊ classroom blogs: writing for/with your peers
- ◊ circumventing the cheating plague
- ◊ power tool for grad students, especially cross-disciplinary



Blogs come in many flavors. Stable genres have yet to emerge but they will.

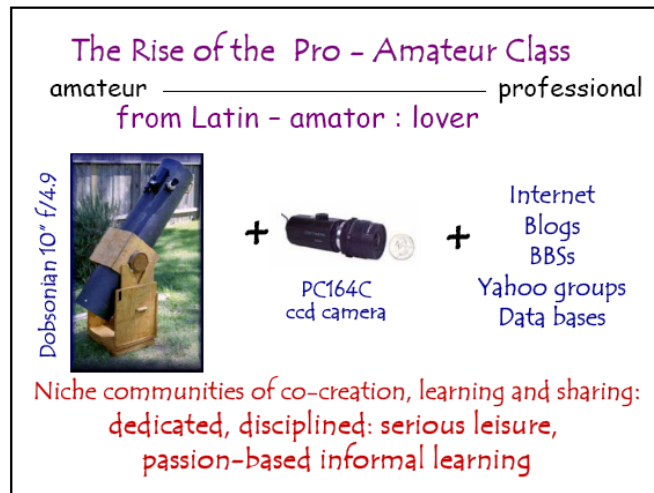
Blogs

The net has enabled another kind of social learning platform, namely blogging. I thought that classroom blogs were a terrible when I first heard about them. Blogs were meant to be fun and informal, done during one's leisure time and driven by intrinsic motivation. Bringing blogs into a classroom would change everything—but, as it turns out, maybe in a good way.

When handled appropriately, classroom blogs can honor multiple ways of knowing and contributing to a class. For those who are too shy to speak out, find speaking in English challenging, or who are more contemplative, the classroom blog can serve as a way to participate in a class discussion. The classroom itself creates a kind of container for a blog – not just a free-for-all blog, but one focused on activities in the class and one tied together by the sociality of all members being in the class. It complements, but doesn't replace, the class and as a container it also allows students to contribute not just their own ideas but also adjacent material they find relevant to the topic of the class. It is also worth noting that students' entries in a classroom blog are written to be read by their peers, not just by their teacher.

As counterintuitive as it may sound, blogging practices may also be helpful in controlling the amount of cheating that appears to be happening on today's campuses. In the blogosphere, cheating isn't likely to happen for both structural and social reasons. Structurally, a blog entry typically links to what someone else has said and builds on or refutes it. The power of blogging has to do with the power of finding what others have written and then linking to and commenting on what you've just found. So the tendency to claim something as totally your own is diminished. From a social perspective, blogs are (semi)-public and your classmates are part of the same blog space. As a result, many different eyes, not just the professor's, examine what is being written. Classmates can be quick to pick up an entry that has been lifted rather than linked to. Similar practices explain why open source code is relatively bug free. As Eric Raymond wrote in *The Cathedral and the Bazaar*, "Given enough eyeballs, all bugs are shallow..." A final twist

on blogging on campus: The blogging medium is beginning to provide a useful platform for graduate students engaged in cross-disciplinary programs to share ideas, raise questions, and more generally get support from their peers – peers often spread out all over campus. Cross-disciplinary endeavors seldom have their own textbooks, journals or even conferences that provide both social and intellectual glue. Blogs can help fill this void and give voice to projects that have no natural home. As campuses move further toward cross-disciplinary graduate programs, we are likely to see more use of blogs in this regard.



Pro-Amateurs

The net is also facilitating the rise of pro-amateurs, which in turn is providing a new kind of learning platform ideally suited for the task of leaning-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.

Yes, amateurs and even serious amateurs—what we are calling pro-amateurs—have existed for centuries. Indeed, the distinction between the two is largely a modern one. Modern science got started primarily by amateurs who would circulate letters about their observations to their colleagues within 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 serendipitous observations, read quite like list postings and blog entries.

The net is giving new impetus to the rise of the pro-amateur class today. First, the letter writing practice that was so crucial to the bootstrapping efforts of the original scientific amateurs now is fostered by blogging practices – especially those of graduate students. Second, 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. Third, 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. Pro-amateur astronomy experienced a tremendous boost from the creation of the Dobsonian telescope – a telescope that can either be built by hand or purchased for a relatively small amount of money. Although these telescopes are small (the largest ones use up to 16 inch mirrors), their imaging power can be dramatically enhanced by using the sensor arrays found in inexpensive security cameras, or ordinary digital cameras, coupled to personal computers. Such a telescope system can have the same effective power that the original 200 inch Mount Palomar telescope had before it was enhanced with digital technology. A very nifty instrument to say the least--especially for as little as a few thousand dollars. The opportunities to tinker with and improve it are limitless.

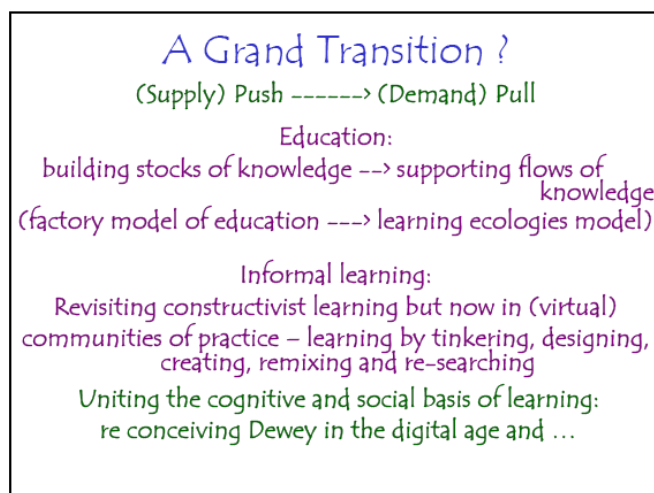
From a technical point of view, the situation is even more fascinating when one realizes that multiple telescopes in different locations can simultaneously capture and transmit images over the net, thus allowing triangulation to occur. But the real power of the net is as a social, learning milieu. Each local pro-am astronomy group can use the net to post images (open source in yet a new way) and discuss what each is 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 has often 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, it is often a pro-am ideally positioned somewhere in the world who first sees it. Depending on the reputation that pro-am has established for him or herself (just as in any open source community), the image can be flashed to a professional for additional validation, at which point the professional alerts the larger community and a decision quickly can be made whether, for example, the Hubble telescope should be re-directed to that location in the sky.

Clearly, a synergistic interaction between the professional 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 professional 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—which is a bit reminiscent of the discussion of the Decameron Web site above.



A Grand Transition?

Each of the examples discussed to this point is interesting in its own right, but the ensemble points to the possibility of a grand transition in education. In the 20th century, the approach to education was to focus on ‘learning-about’ and to build stocks of knowledge and some cognitive skills in the student to be deployed later in appropriate situations. This approach to education 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. The world is continuously changing at an increasing pace. Skills learned today are apt to be out-of-date all too soon. The concept of life-long 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 re-trained 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 more of 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 as well.

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 construction of understanding. Perhaps more importantly, it presents an approach to life-long 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, 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 reflective practicum, but in this case the reflection comes from being embedded in a social milieu supported by both a physical and virtual presence, and by both the amateur and the professional practitioner.

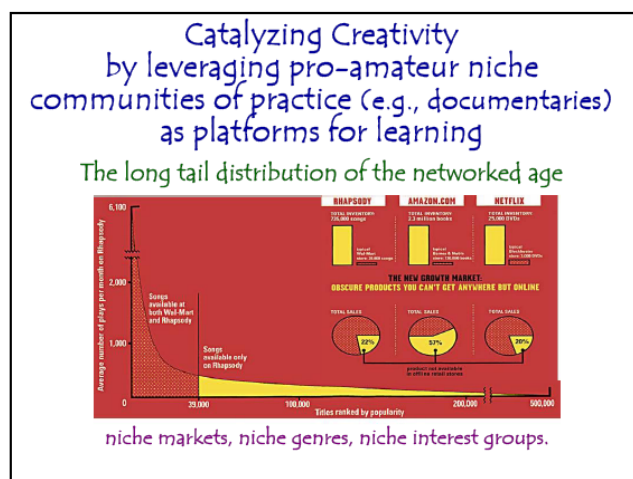


The demand-pull approach to learning appears to be extremely resource-intensive. After all, lecture halls that hold 800 students are almost an ideal notion of a factory model of efficiency – the goal of supply-push. The demand-pull form has no such streamlined equivalent, although we have already seen some clever ways to transform classrooms into studio-based practica. The net, though, is quickly becoming a vast resource for supporting demand based learning. Its potential resources include scholarly websites, which already number in the hundreds, as well as a rapidly growing amount of open courseware in the tradition of OCW, Connexions and open source itself. Additionally, a number of powerful instruments (e.g., electron microscopes) and simulation models running on super-computers can be remotely accessed by learning communities both in and out of school settings. Finally, massively multiplayer game platforms are becoming interesting experimental platforms for the social sciences and are open to anyone who wants to participate.

In the arts, what is now possible with digital movie making, digital photography, and the creation of music using programs such as Garage Band, is limitless. Further, social software enables communities to form and find each other and to learn through remixing, tinkering, and sharing of artifacts--all coupled to rich media. This all adds up to a vast and relatively unexplored learningscape, an experiential medium for learning through participation.

The Long Tail of Distribution

To tie these many examples together and to show how a form of both passion-based learning and learning-to-be might emerge, we need to take a slight detour into the realm of the long tail distributions of the networked age and consider how it applies to education.



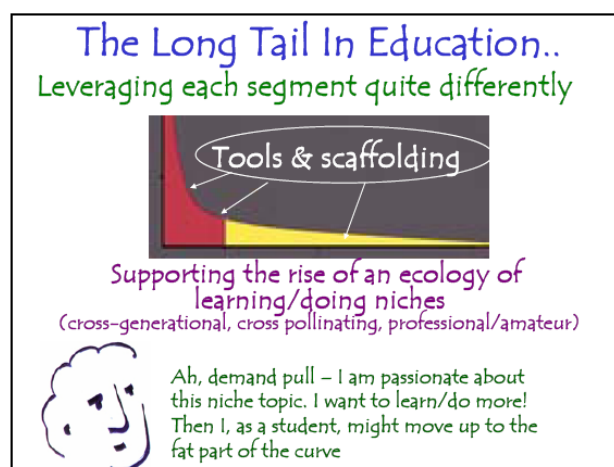
The internet has changed the world of commerce. The retail business has been transformed by the unlimited shelf space the internet offers. Book stores, for example, can physically carry a limited number of titles—even a giant bookstore such as Barnes and Noble can carry only about 130,000 titles. To make scarce shelf space pay off, bookstores must decide which titles will turn over fast enough to make carrying them profitable. Book sales tend to follow the 80/20 rule, which says that 20 percent of the books generate 80 percent of the profit. The books that fall into the 20 percent category tend to be the megahits (e.g., *New York Times* best sellers) and a few others. If you want a book that only turns over once a year, you are not likely to find it in a bookstore. It just doesn't pay to carry it. Physical stores selling movies and CDs also follow the same 80/20 rule.

But then along come companies like Amazon and Netflix. Amazon can afford to carry books that turn over just once a year. Amazon doesn't have expensive stores located in expensive real estate; rather it has a few massive warehouses with extremely sophisticated automation to assemble orders with blazing efficiency. Their warehouse systems look more like the assembly lines of auto factories than bookstores. Amazon has moved book retail from a scarce shelf space to an abundant shelf space mode, and in so doing has broken the 80/20 rule. (It is worth noting that the 80/20 rule also applies to the university, where 80 percent of the revenue is generated by 20 percent of the courses taught.)

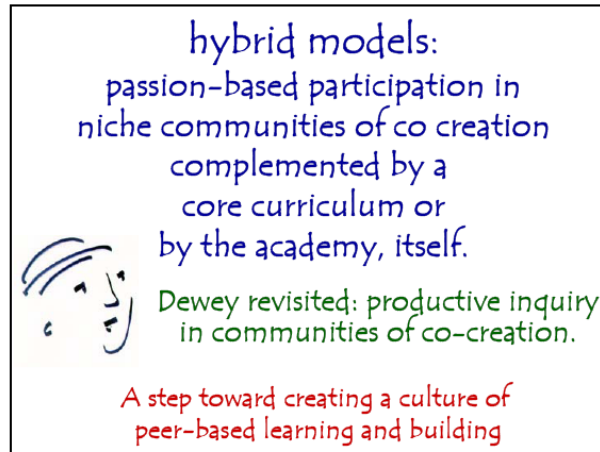
Wired magazine's Chris Anderson has shown that distribution (including both scarcity and abundance) is governed by a law that he has named the "long tail." Surprisingly, Amazon makes more than half of its revenue in the long skinny tail, not the fat head of

its distribution. Amazon wins by serving a vast ensemble of niche communities of interest heretofore not well served. Indeed, until very recently, if you made documentary films there was almost no chance of having them sold in retail stores. Amazon has also changed that by providing a path to the market for thousands of documentaries of interest only to niche communities. Similar to the amateur communities of interest described above, there is a vast number of niche communities of interest that want to make or buy content. Furthermore, the advance recommendation systems of Amazon or Netflixs render mass marketing unnecessary for content to be discovered.

When new mechanisms for distributing content are combined with new power tools for creating that content, along with social software and recommendations systems for finding the content, we have the beginnings of an infrastructure for enabling the rise of the creative, always learning, class –people who want to create and have others build on, use, critique and, most importantly, acknowledge their creations. This presents a new set of possibilities for unleashing a culture of learning by creating, sharing, and acknowledging the work of others in a way that builds both social capital and intellectual capital simultaneously.



The long tail of distribution also applies to the revenue a university receives from its courses. A small number of courses – usually the core courses – produce most of an institution’s revenue. Niche, higher level courses often don’t pay for themselves, and thus tend to be offered infrequently.



Conclusion

I suggest that we are now presented with a fundamentally new possibility for 21st century learningscapes. Imagine a hybrid model of learning, where we combine 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 every 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 and could even become a new role for community public libraries. 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 social and cognitive basis of learning, and enabled by the networked age of the 21st century. Such an educational experience would undoubtedly build a strong foundation for life-long learning in a world of accelerating change.

