The Future of Online Learning: Ten Years On

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In the summer of 1998, over two frantic weeks in July, I wrote an essay titled *The Future of Online Learning*. (Downes, 1998) At the time, I was working as a distance education and new media design specialist at Assiniboine Community College, and I wrote the essay to defend the work I was doing at the time. "We want a plan," said my managers, and so I outline the future as I thought it would – and should – unfold.

In the ten years that have followed, this vision of the future has proven to be remarkably robust. I have found, on rereading and reworking the essay, that though there may have been some movement in the margins, the overall thrust of the paper was essentially correct. This gives me confidence in my understanding of those forces and trends that are moving education today.

In this essay I offer a renewal of those predictions. I look at each of the points I addressed in 1998, and with the benefit of ten year's experience, recast and rewrite each prediction. This essay is not an attempt to vindicate the previous paper – time has done that – but to carry on in the same spirit, and to push that vision ten years deeper into the future.

New Technology

The development of new technology continues to have an impact on learning. While on the one hand, new technology allows schools and instructors to offer learning in new ways, educators nonetheless continue to face limitations imposed by technology, and sometimes the lack of technology. While access to the internet has increased greatly over the last decade, some schools continue to experience bandwidth shortages and most schools do not have enough computers for every student. Yet, this is changing, and the pace of this change will continue to accelerate.

Bandwidth

As administrators struggle against the demands video streaming and bit torrent networks place on backbones, it is hard to imagine saying that bandwidth will be unlimited. But from a certain perspective, from the point of view of most users, bandwidth is already unlimited, as they are able to share text, images and video with ease. The limit of 28K from ten years ago now appears laughable to most urban internet users, as broadband access allows downloads almost a hundred times faster. Applets are now commonplace, a video sharing site (YouTube) is the most popular destination on the internet, and video conferencing (through services such as Skype) is mainstream.

And access to bandwidth continues to improve. The employment of data compression technologies has almost been superseded by fibre-optics technology such as lightpath

management. (van der Pol, 2007) Companies like Verizon are offering fibre-optics to the home. (Verizon, 2008) And while satellite internet did not revolutionize internet access, the spread of Wi-Fi and other wireless technologies created an essentially mobile internet, with Wi-Max, a long-range broadband wireless internet standard, poised to greatly extend that in the future. Bandwidth is in the process of becoming ubiquitous, and though we may complain about the price, it is already, relatively speaking, cheap.

Despite set-backs – for example, the lobbies by private corporations to prevent the deployment of municipal Wi-Fi – it is not unreasonable to expect that inexpensive wireless broadband will be ubiquitous in most populated areas. We can think of it as a service analogous to the deployment of mobile phone services today (and indeed, the providers of tomorrow's broadband wireless may well be today's mobile service providers.

Processing

Computers have as well become more reliable. It is hard to believe that only ten years ago we were upgrading from 75 megahertz processors to 100 or even 130 megahertz machines. The computer this is being typed on, a MacBook Pro, runs a 2.33 gigahertz duo-core processor. And its 3 gigabtye memory dwarfs the 16 (upgradable to 32) megabyte memory we used with our Pentium computers. And while the deployment of these 64 bit computers took rather longer than one would expect, they are beginning to be seen in the home and the office today. (Norr, 2006) Today, 128 bit processors are not really on the horizon, but computer capacity is continuing to increase through the use of multiple processors.

As a result of the use of multiple processors, computers themselves are becoming what might be called 'platform neutral'. Computer programs are being designed to run in 'virtual machines' which can be carried from one hardware platform to another without adaptation. The Java Virtual machine (JVM) is one example of this, but so also are the 'images' produced by virtualization software such as VMWare or Parallels. And specialized computer languages, such as Erlang, are designed to operate in multiple processor environments. (Ericsson Computer Science Laboratory, 2008) These systems manage the interface between the operating system – whether it be Apple, Windows or Linux – and the underlying hardware, thus allowing the same system to be run on varying hardware configurations. The operating system, to these systems, is depicted as a disc file (or 'image'). As a result, it is not unreasonable to imagine people carrying their 'computers' around on ten (or hundred) gigabyte Flash memory drives.

Virtualization will occupy increasing attention in the future. Why? "We see a large number of customers spending less than 30 percent of their IT budget on business priorities, and growth initiatives, and 70 percent or more on management and maintenance. With virtualization and with these broader transformational initiatives, you can really flip the ratio around." (Gardner, 2008)

The combination of ubiquitous broadband and the portable operating system will result in the widespread popularity of what is currently being called 'cloud computing'. The idea is that your computer, as a set of data files, is stored online. As such, it may be access from any hardware environment, including mobile or portable devices. Consequently a person will access their single computing environment from different devices while at home, on the road or in the office. This computer will, in turn, access data and applications provided by remote online services.

Storage

Storage is today widely available and relatively inexpensive. Once almost inconceivable, terabyte hard drives are now available in the local computer store for roughly two hundred dollars.

The rise of Flash memory – now available at 32 gigabytes and counting – and the minidisc used in some MP3 players will greatly accelerate the trend we have already seen toward specialization we have seen in the last decade. Flash memory is solid state, which means it consumes much less power and is much more compact than disc-based storage. Probably the most notable of the specialized computers, the iPod, has become one of the most popular consumer products of all time. Digital cameras have essentially replaced traditional cameras; Polaroid is ceasing production of instant film in 2009. (Winn, 2008) Other specialized computers, such as personal digital assistants (PDAs), global positioning systems (GPS) and mobile phones, dominate the consumer electronics market.

Software

Software has also become more reliable, even though this has been obscured to some degree by the decade-long dominance of the market by Microsoft's Windows operating system. As web-based applications become more widely available, however, more specialized and customizable operating environments will be available to users. Online storage and processing represent yet another virtualization of the computing environment, with the result that personal systems are simpler and more stable. Simple devices – from the One Laptop Per Child computer to the Asus Eee to the Nokia internet tablet to Apple's iPhone now allow people to run complex software with very simple devices. (Arrington, 2008)

Indeed, it is arguable that we have already reached the upper limit of the large single-system software environment. A report from Gartner Consulting, for example, suggests that Windows Vista is collapsing under its own weight. (Dignan, 2008) Microsoft needs to virtualize Windows, to create versions tailored to different devices, simplifying the operating system providing a similar user experience across a wide range of products. Already, Microsoft is reported to be working on an ultralight version of Windows for the

OLPC project. (Smith, 2008) Meanwhile, Nintendo is making the Wii gaming system a web application that streams videos from the BBC. (Waters, 2008) The distinction between 'systems' that characterized the Linux-Mac-Windows battles of the 90s and 2000s will fade into the background.

The best example of this may be seen at the Flickr website. You use a digital camera – a specialized digital computer with an optical sensing device – to take a photograph. You then upload the photo (often wirelessly) to the internet, storing it in your Flickr account. You then, using the Flickr website, access a separate application called Piknik to edit the photo – your photo data is actually sent from Flickr to Piknik, and you use Piknik servers to perform the manipulations. After returning your photo to Flickr, you employ yet another application that will print the photo and, combined with a shipping service, send you a nicely framed enlargement.

Specialization

Computers are becoming more specialized, and we are beginning to think of them as devices used for specific purposes – gadgets – rather than as computers at all. Pulse-monitoring devices, global positioning systems, toll system tags, e-book readers, writing tablets: all these and more are forming an increasingly large part of our landscape (for many *many* gadgets see websites such as gizmodo.com). Desktop computers themselves are shrinking as designers make them more portable and more energy-efficient. (Fried, 2008)

Computers – and more specifically, processors, storage devices and wireless communicators – are being embedded into everyday devices. Despite early hiccups, WalMart continues its drive to have RFID wireless transmitters embedded in all products it sells, for example. (Wailgum, 2008) These chips will be used to track inventory and facilitate check-out. Meanwhile, fads such as wearable computing come and go, harkening a day when our clothes will monitor our vital signs, keep track of where we've been, and function as camouflage or a computer screen. (Busari, 2008) Digital technology is becoming a part of our lives, embedded in everything, much in the way paper permeated the lives of earlier generations.

Widgets and Webtops

In 1998 I wrote that computer programs of the future will be function based, that they will address specific needs, launching and manipulating task based applications on an as needed basis. For example, I said, the student of the future will not start up an operating system, internet browser, word processor and email program in order to start work on a course. The student will start up the course, which in turn will start up these applications on its own.

The 2008 instantiation of this idea is the widget. A widget is a piece of code – typically written in Flash or Javascript – that resides on a desktop or web page and performs a specific function. (WebProNews, 2008) Thousands of widgets exist and may be found on

download pages at places like Yahoo! and Apple or from specialized content sources such as national Geographic. (National Geographic, 2008) A widget obtains content from one website and displays it on another website. Often user interaction is provided – the user might type a term into a search widget, for example – and often some form of processing is requested at the remote website.

Widgets can be combined as a collection of services through web sites called 'webtops'. These websites, such as PageFlakes and Netvibes, import content and services and arrange them on a page according to user settings and preferences. (Oehlert, 2006) Ands we can see learning management systems such as Desire2Learn adopt the same approach to design, creating personalized course home pages out of a set of associated widgets. (Weiser, 2008) It does not matter what operating system is used to view such pages because they are displayed inside the web browser.

Embedding

Computers – essentially, little processors with wireless access to the ambient internet – will be embedded in everyday products. I have spoken in the past about the fishing rod that teaches you to fish or the jar of strawberry jam that teaches you about jam, as well as the example from Bruce Sterling's *Distraction* about the hotel that teaches you how to build it. (Sterling, 1999)

New Technology in Education

While technology changes rapidly, people do not. People want to use tools that look and feel like tools they've always used, and will tend to adopt tools only if they see a clear benefit either in productivity or in savings. (Starr, 2003) Since education is a domain that inherently involves people as both practitioners and clients, it seems clear that when we think about the adoption of new technology in education, we need to think as much about what people will want and are likely to do as about the new technologies that will be available.

In particular, education is fundamentally a process of communication (*learning*, by contrast, is fundamentally a process of growth). (Richter, 1995) As such, educators over the years have attempted to keep the use of tools to a minimum, and as invisible as possible, and to focus on the teaching. How many times have we heard the refrain that pedagogy should not be driven by technology?

When we example the teaching process – one that remains largely unchanged even through the first decade of the internet – we see this emphasis on dialogue and communication. And it should not be surprising that the first major type of technology to be adapted, the learning management system (LMS), was originally named 'World Wide Web Course Tools' (or WebCT, as we later came to know) (Goldberg, 1996). Basic technology, such as the book, the notepad, the blackboard, and the teacher were all either emulated or facilitated within WebCT.

The PAD (Personal Access Device)

In 1998 I wrote that 'The PAD will become the dominant tool for online education, combining the function of book, notebook and pen." The PAD, I said, would be "a lightweight notebook computer with touch screen functions and high speed wireless internet access." I also said it would cost around three hundred dollars.

By 2008, the prescience of that prediction has been proven. Early tablet computers produced by QBE won Comdex 'Best of Show' awards in 1999 and 2000. (Viherlahti, 1999) In 2002 Microsoft released the Windows XP Tablet PC Edition to support tablet technology. (Thurrott, 2002) It included handwriting recognition and voice commands. Today, arguably, the tablet computer has become so widespread.

Of most significance, tablet computers have in recent years reached the price point predicted in my 1998 article. Probably the most notable of these is the XO Computer, but for the One Laptop Per Child (OLPC) project, which was sold for just under $200. (Bsales & Bsales, 2007) Other computers selling for less than $300 quickly followed, including the Intel Classmate and the Asus EEE. Meanwhile, Apple's iPod touch, ostensibly a music player but in fact a small wireless computer, was widely popular.

With slim, lightweight technology, truly useful and portable PADs will be widely available within the next ten years. We have already seen significant improvements in screen technology, including slim touch-sensitive screens. Wireless access and cloud computing make bulky storage devices unnecessary; what local memory is needed will be more than adequately managed using tiny flash memory chips. Improvements in battery life and solar power will mean that these low-wattage portable computers will run for days. They will, as I suggested before, come in all shapes and sizes, from a slim pocket version (much like the iPod touch) to a notepad version.

Display Technology

The same technology that makes PAD technology possible will continue to proper improvements in large screen displays (devices I nicknamed WADs (Wide area Displays) ten years ago).

The age of wide area displays has already arrived; with the conversion to high definition digital television in February 2009 (Federal Communications Commission (FCC), 2008) manufacturers have been selling wide-screen plasma and light emitting diode (LED) monitors. These distinct technologies have in common not only the ability to support flat monitors (as compared to the bulky cathode ray tubes used in traditional televisions) they also consume less power and produce less heat.

In the future, it will be common to see these large-area displays hanging on living room and classroom walls. Instead of being the size of small windows, they will be the size of large blackboards. They will be touch sensitive (or if not, connected to a pointer tracking

system device similar to the ones being cobbled together for less than $50 by Wii enthusiasts (Lee, 2007)) or included with any of a number of children's educational webcam games today (such as Camgoo, among many others).

Projection technology is also coming down in price and improving in power and portability. It is now not uncommon for people to build home movie theatres using computers or DVD plays along with a digital projector and wall or screen. And projection technology, combined with mobile phones, is touted in some circles as a wave of the future. (Tran, 2007)

Portable, Personal, and Global

The combination of portable and affordable computing devices, combined with widely available digital presentation tools, will make education genuinely personal and portable.

Imagine having in your hands a device on which you can not only write or type content, but which takes photos and records videos. Imagine further that this device contains easy-to-use but powerful photo and video editing software, and is additionally connected to a massive library of content made available through ambient broadband internet connections.

Moreover, imagine that any environment that contains a flat surface can become a teaching environment, one where your friends' faces (or your parents' or your teachers') can appear life-size on any old wall or on a table surface as you converse with them from the next room or around the world. We have already seen how the availability of mobile telephones has transformed society in less than a generation. (New Media Consortium, 2008) Having much more powerful, much more expressive, communications technology available everywhere will have a similar impact.

It is important to think not simply about how these technologies will operate individually but rather about how they will operate in combination. A person will move content online and offline with ease. Software and multimedia will no longer be associated with hardware or other devices but will rather be associated with individuals and will express their personal preferences. We are already seeing this as people can download and carry their own portable applications around with them. (PortableApps.com, 2008)

Each person will have what may be thought of as a 'profile' of their own art, music and other media, which they have created themselves or with friends, along with records of their activities in various games and simulations (we see things like this already with applications like Launchcast) that take place both on and off line. (Breeding, 2005) They will be able to be in constant audio and video contact with family and friends, meaning that families and groups will never really be separated unless one of them chooses to be.

Presentation Software

The term ‘presentation software’ can be used to refer to applications designed to display learning material to students. (TechTarget, 2005) In the past, these learning materials were confined to physical media such as video tapes or CD-ROMS. And a lot of educational material continues to be presented in such formats today; any parent can describe the wide array of children’s titles available at the local software store.

Learning materials are now available online as well. Probably the most representative (and most saturated) market is the language learning market, where providers market audio and video clips, flash cards and memory aids, study guides, and much more. Additionally, numerous applications are marketed to parents of small children; these vary from quiz applications to games to online communities.

That said, the presentation software market has divided itself roughly into two parts. On the one hand, sophisticated tools have been placed into the hands of instructors and non-professionals to facilitate the creation of multimedia presentations. To name just a few, we could point PowerPoint, which allows instructors to create slides; to Audacity, which facilitates audio recording and editing, Adobe Premiere Elements, an inexpensive and accessible video editing tool; Camtasia, a screen-recording and video editing tool; and Second life, which enables people to create three-dimensional objects.

On the other hand, even more sophisticated tools have been placed into the hands of professional designers. In addition to professional versions of the content creation tools, programming studios and integrated development environments enable developers to create sophisticated games, simulations and other educational applications. Thus there is, at any given time, a professional educational content community that creates high-end and custom educational content and a non-professional community that creates (relatively) low-end and more personalized educational content.

This is a trend that is likely to continue, though it is also likely that the line dividing the professional from the non-professional community will become increasingly elusive over time. Generally, as a domain of software design becomes well known, sets of tools for content creation are developed, which in time become widely accessible. Several recent waves in technology are reflective of this trend.

The first of these is the notion of the ‘software object’. (Sun Developer Network, 2008)This concept, which in education became the idea of the ‘learning object’, emerged as a result of the idea that reusable software objects could be created. These objects – a ‘menu’ item, for example, or a ‘task bar’, were made available in drag-and-drop programming environments, such as the Windows .Net environment. (Downes, Learning Objects: Resources for distance education worldwide, 2001) The idea that educators could assemble learning materials out of predefined components has never been abandoned.

The second is the concept of ‘Web 2.0’ that has recently swept the internet. (O'Reilly, 2005) Web 2.0 is actually a cluster of technologies that combine to allow web sites to become interactive. At the heart of these technologies – things like Asynchronous

Javascript and XML, for example – are collections of software applications called 'frameworks' that automate the way web software handles the storage and retrieval of data and contents. Early frameworks included Cold Fusion, WebObjects and J2EE. Web 2.0 emerged with the release of lightweight open source frameworks such as Ruby on Rails. (Poteet, 2008)

Games and Simulations

A great deal has been written in the last few years about educational games or, as they are sometimes called, 'serious games'. (Eck, 2006) In 1998 I wrote that "educational software of the future will include every feature present in video games today, and more." Though this hasn't proven to be strictly true, it is largely true, and probably no more true than in the domain of games and simulations.

Though there are different types of games, including quiz-games and branching games, the sort of games I felt most appropriate to educational use were learning environments such as were to be found in games like Sim City or Sim Earth. These games, now known as 'spreadsheet games', involve the creation of a large body of interacting data sets. Players manipulate both data sets and interactions, and resulting data states create the gameplay. (Aldrich, 2005) (Kapp, 2005)

While the last ten years have seen a fair amount of attention paid to such games, through the development of modification kits for gaming engines such as Civilization, even more attention has been paid to another class of educational software, the simulation. Once used only for high-end training, such as for aircraft or helicopter pilots, simulations have become in recent years cheaper to produce and hence more accessible. These can be built from stand-alone programming libraries, but can also be developed from modified gaming engines. This, for example, is what the Canadian Forces did, modifying the popular SWAT 'First Person Shooter' into a collaborative training simulation. (Mahood, 2007)

The tools that we use today were in development in 1998 – multimedia or content engines such as PowerPoint or Director, development environments such as .Net, programming languages such as Java or Ruby, rendering systems such as VRML or SMIL. These now are disappearing into the background, while practitioners are working directly with content creation tools, both on the desktop and on the web.

The World Wide Web today contains millions, and maybe billions, of (what used to be called) presentations, ranging from blog posts to wiki entries to videos posted on YouTube to Flickr photographs to SlideShare slide shows. As complex multimedia presentations become more modular, as they come to be based more on things like objects and frameworks and modification kits, we will see the same phenomenon for game and simulation content, where millions of resources will create complex and rich materials where, formerly, everyone would have to make do with a relatively simple offering from a publishing company. (Downes, Places to Go: Apolyton, 2005)

In 1998, I wrote the following: "To give a student an idea of what the battle of Waterloo was like, for example, it is best to place the student actually in the battle, hearing Napoleon's orders as they become increasingly desperate, feeling the recoil of one's own musket, or slogging through the mud looking for a gap in the British cannons." (Downes, The Future of Online Learning, 1998) Today we can say that the creation of such simulations will not be simply the domain of large production houses, but will rather be more and more the result of massive collections of small contributions from individual players. And that the creation of content – *any* content – needs to take this phenomenon into account, or be seen as abstract and sterile.

Interaction and Online Conferencing

In recent years educators have come more and more to believe that the presentation of educational content is but a small part of the learning process. To paraphrase the Cluetrain Manifesto, which came out roughly the same time as the Future of Online Learning, "all classrooms are conversations." (Levine, Locke, Searls, & Weinberger, 1999) To that end, online conferencing in education has become important, not simply as a means to advance our knowledge of the subject area, but as a means to advance our understanding of communication using online technologies.

That said, online conferencing technology has become, for the most part, cheap and ubiquitous. The purchase of large-scale interactive television suites is largely a thing of the past, and while enterprise conferencing technology remains at a relatively high price point, effective and inexpensive technologies are bringing conferencing to the masses. The future will see a continuation of this trend, to the point where there will be little difference between taking part in an online conference and being in the same room.

Synchronous Conferencing

Though I stated in 1998 that interactive television "will be obsolete within five years" there is still a great deal of love bestowed on the technology at the corporate and governmental levels. The World Bank spent millions of dollars building ITV labs in developing nations, while companies invested additional millions in Polycom units. (Veldanda, 2003) Even as I write, development of high-bandwidth videoconferencing technology continues; we have an 'Advanced Collaborative Environments' in our own building. (National Research Council Canada, 2005)

These are slowly being replaced by desktop videoconferencing. Probably the most important aspect of this is the deployment of web cameras (or computer interfaces to video cameras, such as provided by Pinnacle) of suitable quality for large screen images. As well, software, such as XMeeting for the Macintosh, has been developed to allow computers to access the H.323 standard used by videoconferencing units.

We have also seen in the field of education the development of conferencing suites such as Elluminate or Centra Symposium. As I noted in 1998, people will want a system that transfers data as well as video signals. These applications do that, providing audio and video communication while also allowing application and desktop sharing, whiteboards and notes, polling, text messaging, and more.

While the systems typically used in an educational environment are commercial applications involving some cost, similar applications are rapidly becoming available for free to the average user. Launched in 2003 (and acquired by eBay in 2005), Skype provides free audio communication (and as of 2006, free video communication) to users around the world. (Skype, 2005) Moreover, open source conferencing suites, such as Dim Dim and WiZiQ, are emulating the function of commercial applications.

However promising it may be, the field of synchronous conferencing remains fraught with tensions between the conferencing community and the commercial providers of conferencing services. Telecom companies, especially, are concerned about losing toll traffic to free alternatives. Companies continue to offer proprietary (and non-interoperable) conferencing protocols. Even something as simple as an instant messaging standard has eluded the domain for many years.

Asynchronous Conferencing

If there is a contrast with the synchronous mode of communication, it is the asynchronous, which has blossomed in recent years. There is today almost no end to the conferencing options available to web users, with the result that the web is now an unparalleled richness of content.

Two major trends have characterized the last ten years of asynchronous conferencing.

First, as was easy to predict in 1998, the dominance of text-based content has given way to a much wider range of formats. Audio content became popular with file sharing and music content services, as well as with the rise of podcasting in 2003. Video content became widely available following the development of Flash video services and of sites like YouTube, which allowed users to upload and convert their videos. (Knowledge@Wharton , 2006) Flash has also been instrumental in the provision of other forms of content, such as slide shows, games, animations, and more. (Lamb & Johnson, 2006)

Second, and less obvious, was the evolution of asynchronous communication. In 1998 most people were still using traditional web conferencing systems such as the email mailing list or Usenet news systems. Early web conferencing systems followed the same format, taking the form of threaded conversations on web bulletin boards. This system was followed in just a few years by blogging. Messages were sorted chronologically by author, instead of by subject, and each person managed his or her own blog. Groups of people, meanwhile, congregated on content management systems such as Drupal or Plone. But as people drifted back to centralized sites, and as linking to other people

became more important, sites that support social networks rose to prominence and people began to spend less time on places like Blogger and LiveJournal and more time on places like MySpace and Facebook.

There is clearly a role for hosted conferencing systems in the future, if only because people do not want to take the time and trouble to set up media processing software. But there will continue to be an evolution of the model as developers search for the right balance between social function and individual identity, between the common software platform and individual control. (White, 2006)

Conferencing Standards and Protocols

In conferencing we see a trend that has been resisted as must as it has been inevitable: that once content standards have been widely adopted for some type of medium, content expressed in that medium has become commoditized (that is to say, widely available at prices that approximate zero).

The first clear example of this is what we not think of as 'plain text' – the ASCII character code. It rapidly became the standard medium of communication online, in both email and message boards. In very few cases was 'ASCII content' marketable. Subsequently, HTML content was also widely (and freely) available. More recently, with the widespread adoption of the MP3 audio format, file sharing became widespread and the value of audio recordings online became negligible. (Przywara, 2008)

Efforts to monetize content have, in turn, typically involved the creation of proprietary content formats. Thus we saw, in the earlier days of the internet, the creation of locked PDF files. Or the development of Real Audio's Proprietary Real Media format (backed by the Real Media store). Or the proprietary Skype audio format. Or, more recently, proprietary iTunes audio formats, and iPhone applications. Or even the proprietary text format used by Amazon in the Kindle, a device it intends to use to sell electronic books. (Gruber, 2007)

These two tensions come to a head in the domain of computer conferencing. The very act of communication requires a set of communication standards that anyone can use – a language, like English, or a medium, like paper. For people who wish their message to be heard (or read, or seen) these need to be widely available and easily accessible, to be (for all practical purposes) open standards. Thus, the push toward online conferencing is at the same time a push toward commoditized content. (Rossi, 2003)

In the end, the standards win, because, in the end, the people win. Societies – or groups, or communities – that sustain effective communication are more robust than societies that control it. There is a significant loss of efficiency in environments of closed, controlled communication. Thus, although artificial constraints will continue to be used maintain proprietary communications formats, the standards will win out.

Personalized Learning

We now have powerful and inexpensive computers we can sling over our shoulder or carry in our shirt pocket. (Yamamoto, 2006) These computers are connected wirelessly to the internet at bandwidths sufficient to allow instant multimedia communication anywhere on the planet. These computers will only improve in the years ahead, becoming faster, slimmer, and more affordable. And we are not at the point where we are seeing the possibility that education may be deeply personalized.

To date, much of our attention, even in the field of online learning, has been focused on a system of learning centered on the class or cohort: groups of students studying the same curriculum pace through the same set of learning activities. (Fenning, 2004) We continue to organize classes in grades, sorted, especially in the earlier years, by age. Time continues to be the dominant metaphor for units of learning, and learning continues to be constrained by time. As it was ten years ago, the model is that of a group of people starting at the same time, studying the same materials at the same pace, and ending at the same time.

And as I noted ten years ago, this model of education was adopted because it was the most efficient. (Hejmadi, 2006) While we want to provide personalized attention, especially to submitted work, testing and grading, learning is still heavily dependent on the teacher. But because the teacher in turn is responsible for assembling, and often presenting, the materials to be learned, customization and personalization have not been practical. So we have adopted a model where small groups of people form a cohort, thus allowing the teacher to present the same material to more than one person at a time, while offering individualized interaction and assessment.

What we have begun to notice with online learning, however, is a decreasing emphasis on this formal style of learning, and an increasing emphasis on what has come to be called informal learning. (Chivers, 2006) In the case of informal learning, students are not constrained by the limits of the classroom model. They can set their own curriculum and proceed at their own pace. (Moore, 1986) Learning can thus be based on a student's individual needs, rather than as predefined in a formal class, and based on a student's schedule, rather than that set by the institution.

Groups Versus Networks

The continuing trend in formal learning to structure learning opportunities as classes and cohorts requires explanation. Underlying the transition from formal, structured learning to more informal and more unstructured learning is not simply a technological change but also a social change. It is this change I have attempted in recent years to capture under the heading of 'groups versus networks'. (Downes, Groups Vs Networks: The Class Struggle Continues, 2006)

Traditionally, people have been seen to learn either as individuals or in groups. This characterization of organization is not unique to education; it is very common to talk of

(say) the needs of the individual versus the needs of the state. This characterization, however, glosses over the possibility that there may be more or less cohesive ways of organizing people, thus allowing for a middle point between the individual and the group: the network.

Though networks have always existed, modern communications technologies highlight their existence and given them a new robustness. Networks are distinct from groups in that they preserve individual autonomy and promote diversity of belief, purpose and methodology. In a network, however, people do not act as disassociated individuals, but rather, cooperate in a series of exchanges that can produce, not merely individual goods, but also social goods.

Traditional learning composed of classes and cohorts operates more as a group than as a network. (Davis, 1993) Students pursue the same objectives employing the same methodologies. This is especially evident in corporate learning, where they are expected to share the same vision and to be pursuing the same outcomes. Learning in such classes is frequently collaborative, as students work in small groups to produce a common project or outcome. (Mohn & Nault, 2004) Interaction is structured and led by an instructor. Classes are closed; there is a clear barrier between members and non-members.

In the case of informal learning, however, the structure is much looser. People pursue their own objectives in their own way, while at the same time initiating and sustaining an ongoing dialogue with others pursuing similar objectives. Learning and discussion is not structured, but rather, is determined by the needs and interests of the participants. There is no leader; each person participates as they deem appropriate. There are no boundaries; people drift into and out of the conversation as their knowledge and interests change.

Learning Management and Competences

The ‘educational delivery’ (ED) system I postulated in 1998 became what we now know as the learning management system (LMS). However, unlike what was projected then, the LMS was not based on personalized learning, but rather, preserved the course management structure that prevailed in schools and universities. (Jarche, 2006) Indeed, early incarnations of the LMS were seen as extensions to the classroom, as evidenced by the name ‘web course tools’ (Web CT). That said, even in traditional educational institutions, the trend is shifting away from courses and toward topics. This is seen in the development of competence-based learning designs, such as in the TenCompetence project. (Kraan, 2006)

The idea of competences is that they are based on identifiable skills or capacities, and hence are not rooted in a body of content but rather in a student’s personal growth. (Karampiperis, Demetrios, & Demetrios, 2006) As such, students are able to select their own track or achievement path through a competence domain, as informed by their own interests, employer needs, or in the case of younger students, parental guidance. Each

competence, meanwhile, corresponds to a selection of learning resources (and specifically, learning objects). (de-Marcos, Pages, Martinez, & Gutierrez, 2007)

It is not clear that such a system will meet the needs of learners. Insofar as this is a form of autonomous learning, it is not clear that it supports collaboration or cooperation. Moreover, it is not clear that an outcomes driven system is what students require; many valuable skills and aptitudes – art appreciation, for example – are not identifiable as an outcome. This becomes evident when we consider how learning is to be measured. In traditional learning, success is achieved not merely by passing the test but in some way being *recognized* as having achieved expertise. A test-only system is a coarse system of measurement for a complex achievement.

Personal Learning Environments

In the future, competences will be just one way (and an unusually employer-centered way) to select learning opportunities. What we will see, rather, is that the selection of learning opportunities will not be a stand-alone activity, but instead will be embedded in other activities. (e-Lead, 2008) One can imagine how players learn in the course of a game, for example. They do not first learn how to play the game, and then play it. Rather, they begin playing the game, and as they attempt to achieve goals or perform tasks, the learning they need is provided in that context. (Wagner, 2008)

The 'personal learning environment' (PLE) is a collection of concepts intended to express this idea. (Liber, 2006) The PLE is not an application, but rather, a description of the process of learning *in situ* from a variety of courses and according to one's personal, context-situated, needs. The process, simply, is that learners will be presented with learning resources according to their interests, aptitudes, educational levels, and other factors (including employer factor and social factors) while they are in the process of working at their job, engaging in a hobby, or playing a game.

The environment that they happen to be in, whether it be a productivity tool, hobbyist web page, or online game, constitutes (at that time) the personal learning environment. Resources from across the internet are accessed from that environment: resources that conform to the student's needs and interests, that have been in some way pre-selected or favorably filtered, and that may have been created by production studios, teachers, other students, or the student him or herself. Content – interaction, media, data – flows back and forth between the learning environment and the external resources, held together by the single identity being employed by the learner in this context.

In time, the learning management systems deployed by educational institutions will evolve into educational delivery systems usable by personal learning environments. They will, in essence, be the 'remote resource' accessed from a given context. Educational delivery systems will recognize the identity of the student making the request and will coordinate with *other* online applications (which may include commercial brokers, open resource repositories, or additional student records) to facilitate the student's learning activity.

We might think that these educational delivery systems will be delivering learning objects. This is not entirely incorrect, although a learning object today has come to be seen as more like a unit of text in a textbook or a lesson in a programmed learning workbook. It will be more accurate in the future to say 'learning resource', since many such resources will be available that do *not* conform to the traditional picture of a learning object – and may be as simply as a single image, or as complex as a simulation or training module.

Content Versus Conversation

Our picture of learning technology today – whether it be an LMS like Blackboard or Desire2Learn, an authoring system such as Connexions, or a resource such as OpenCourseWare – is that learning systems are essentially content delivery systems. Hence, they are typically based on a publication model of storage and distribution, are institutionally based, and tend to focus on mass deliveries of common materials to classes or cohorts. We see this in the design of the system, the technical specifications (such as 'content packaging') and in their deployment.

The personal learning environment, however, is not based on the principle of access to resources. It should more accurately be viewed as a mechanism to *interact* with multiple services. (Milligan, 2006) The personal learning environment is more of a *conferencing* tool than it is a content tool. The focus of a personal learning environment is more on creation and communication than it is consumption and completion. It is best to think of the interfaces facilitated by a personal learning environment as ways to create and manipulate content, as *applications* rather than resources.

In particular, that the various channels created by the PLE enable is for a student to form a set of connections with a collection of individuals at any given point. In 1998, I referred to this as the *Quest Model*, based on the idea of *ad hoc* collections of people grouping together to solve puzzles in online multi-user environments such as Multi User Dungeons (MUDs). This model has become much more widespread, but no less *ad hoc*, as people today connect with each other to have distributed conversations, to create wiki entries, to collect resources in discussion threads, and like activities.

In the Quest Model, each achievement would become a part of a personal profile, a part of a learning record that would in turn inform future challenges. This idea is reflected today in the concept of the e-portfolio, where the products created through the process of engagement and interaction are stored and (digitally) mounted for display. We see today the idea of an e-portfolio taking hold *outside* traditional learning – people have their own blogs, their own Flickr photo portfolios, art projects on Deviant Art, game modifications, fan fiction, open source software, and much more.

The products of our conversations are as concrete as test scores and grades. (Ryan, 2007) But, as the result of a complex and interactive process, they are much more complex, allowing not only for the *measurement* of learning, but also for the *recognition* of

learning. As it becomes easier to simply *see* what a student can accomplish, the idea of a coarse-grained proxy, such as grades, will fade to the background.

Connectivism

The educational institution is unlikely to disappear, but it is unlikely also to remain the sole locus of student learning. Educational institutions will need more and more to think of themselves as part of a larger system, and as their offerings as entities that will become a part of, and interact with, the larger environment. Consider, for example, the photo editor that connects to Flickr, described above. Now imagine what an *art appreciation* resource would look like, how it would interact with Flickr photos. (Unattributed, 2006)

Educational technologists should additionally not only think of themselves as building systems that contribute to the network of resources, but also of systems that *draw* from that network to create value-added resources. For example, a recent TED demonstration saw an application that created a three-dimensional composite image of Notre Dame Cathedral composed from thousands of Flickr photos. (Arcas, 2007) Educational institutions can in the same way create pictures of our understanding of other – less concrete – concepts that can be found in the thousands and millions of bits of content created by people around the world.

This is the fundamental understanding behind a learning theory developed to describe learning in networks, connectivism. (Siemens, 2004) The theory proposes that knowledge is contained, not merely in the bits of information transmitted to and fro as content and creations, but in the way these contents, and the people that create them, link together. Just as the activation of the pixels on a television screen form an image of a person, so also the bits of information we create and we consume form *patterns* constituting the basis of our knowledge, and learning is consequently the training our own individualized neural networks – our brains – to *recognize* these patterns.

The purpose of educational institutions, therefore, is not merely to create and distribute learning opportunities and resources, but also to facilitate a student's participation in a learning environment – a game, a community, a profession – through the provision of the materials that will assist him or her to, in a sense, see the world in the same way as an accomplished expert; and this is accomplished not merely by presenting learning materials to the learner, but by facilitating the engagement of the learner in conversations with members of that community of experts.

Learning Resources

As discussed above, educational institutions will need to see themselves as providers of learning resources (and not merely learning objects). These resources will be online services that connect students with: learning content; games, simulations, and other activities; *ad hoc* communities of learners; and experts and other practitioners. They will be specialized multimedia content consumption, editing and authoring systems designed to facilitate a student's ability to perceive and perform as modeled by experts in a community of practice.

These resources will not be inert content objects, but rather, will need to be able to learn about the environment they are being offered in, be able to learn about the student, and to get this information not just locally but from wherever it may be on the internet. Thus, such resources must be able to communicate state and other information to and from other (authorized) systems and services. They *may*, therefore, be fully-fledged web services, but they are just as likely to be lightweight applications depending on other simple services to do much of this work for them.

Today, institutions do not yet know how to deliver information to other systems. Beyond interlibrary loans, we have (at best) identity federation systems such as Shibboleth. Learning resource sharing networks, such as Globe, are small, ineffective, and exclusive. However, institutions are beginning to learn to prepare content for distribution through remote systems, such as the provision of lectures for delivery through iTunes University. Such systems will evolve over time into a mature system of open content distribution, facilitated through open access mandates, repository and other server software, and content and interaction standards.

Flow and Syndication

Understanding learning as 'conversation' (Sharples, 2005) also allows us to look at the management and distribution of learning resources a bit differently.

Today, as noted above, we tend to think of such resources as static and bibliographical, like books in a library, where contents are 'published' and then 'stored'. This view is evident in much of the discussion that surrounds learning technology today. We think of work as being stored in a research repository, indexed and archived, in such a way that we can search for them, typically through a catalogue (or metadata) system, and retrieve them. (Barker, 2007) The major concerns of educators in this environment are things like persistence and provenance, copyright and reproduction. (Jantz & Giarlo, 2005)

In the networked learning environment, however, learning resources are best thought of not as *content* objects *about* a discipline that are retrieved and studied, but rather as *words* in a multimedia vocabulary that is used by students and teachers in an ongoing conversation *within* a discipline to engage in projects and activities. (Downes, The New Literacy, 2002) Content and learning resources, rather than being thought of as static objects, ought to be thought of as a dynamic flow. They are more like water or electricity and they are like books and artifacts.

The technology of learning – and of the web generally – is evolving to accommodate flow. (Jarche, Learning is Conversation, 2005) Probably the most significant development in the last ten years has been the deployment of the Rich Site Summary standard – RSS – that allowed content creators to syndicate their writings and other creations. Using RSS feed readers, web users do not go to web pages or search for content, but rather, subscribe to RSS feeds and let the content come to them. (Downes, An Introduction to RSS for Educational Designers, 2003)

Most educators, and most educational institutions, have not yet embraced the idea of flow and syndication in learning. They will – reluctantly – because it provides the learner with the means to manage and control his or her learning. They can keep unwanted content to a minimum (and this includes unwanted content from an institution). And they can manage many more sources – or content streams – using feed reader technology.

RSS and related specifications will be one of the primary ways Personal Learning Environments connect with remote systems. To use a PLE will be essentially to immerse oneself in the flow of communications that constitutes a community of practice in some discipline or domain on the internet.

What It Isn't

When people think of personalized online learning, they frequently think of adaptive systems, learning programs powered by artificial intelligences that test a student's competence, formulate customized lesson plans based on those pre-tests, and then measure a student's performance though a series of online activities. (Boticario & Santos, 2007)

While people will no doubt pursue solo learning activities (just as they, by themselves, read books today) this will not constitute the core of the learning experience in the future (just as reading books does not constitute the core of learning today).

Even though learning systems will be able to auto-grade tests, will be able to track progress through a set of learning activities, and will be able to facilitate a wide variety of measures, these results will not constitute, by themselves, 'evidence' of learning. Students will demand that there be a human element to evaluation, as they realize that their own performance is varied and complex, and may not be measured accurately by a machine, and employers and others will require a human element, because they will understand that humans devise endless schemes to 'game' or otherwise trick automated systems.

In the end, what will be evaluated is a complex portfolio of a student's online activities. (Syverson & Slatin, 2006)These will include not only the results from games and other competitions with other people and with simulators, but also their creative work, their multimedia projects, their interactions with other people in ongoing or ad hoc projects, and the myriad details we consider when we consider whether or not a person is well educated.

Though there will continue to be 'degrees', these will be based on a mechanism of evaluation and recognition, rather than a lockstep marching through a prepared curriculum. And educational institutions will not have a monopoly on such evaluations (though the more prestigious ones will recognize the value of aggregating and assessing evaluations from other sources).

Earning a degree will, in such a world, resemble less a series of tests and hurdles, and will come to resemble more a process of making a name for oneself in a community. The

recommendation of one person by another as a peer will, in the end, become the standard of educational value, not the grade or degree.

Time and Place Independence

The dependence of online on the computer over the last decade has masked the fact, but online learning is at heart a form of distance learning, and therefore offers as one of its primary advantages a form of time and place independence for the learner. Cloud computing and mobile computing will offer these forms of independence. They can, indeed, be thought of as offering a third, equally important, form of independence: *device independence*.

Time Independence

We are well used to the idea that students, whether working in traditional online courses or independently through informal learning, will access their materials and activities at any time of the day. They can work any day of the week, or if they are employed in agriculture or some other seasonal occupation, any time of the year.

That said, many institutions have, for administrative reasons, maintained the traditional schedule. Online classes still start in September, synchronous sessions are held once a week at a set time, and students are expected to maintain a traditional work schedule. But there is no academic or technological reason to stick to such a schedule, and we see learning events scheduled outside the institution, such as those run by Ed Tech Talk, run any time of the year and any day of the week.

It may take a larger cultural shift to shake the traditional institution's understanding of, and dependence on, time. Classes and courses are still represented in calendars as 'credit hours', as though the 'hour' were a unit of knowledge or learning. Perhaps the most inventive way to escape this limitation is Google's invention of the 'Knol', which it represents as a 'unit of knowledge'. (Manber, 2007) Others identify the 'smallest unit of learning' with the 'learning object'. (Christiansen & Anderson, 2004) Either way, time is ceasing to be an objective standard of learning.

That said, the possibilities inherent in the independence of time have yet to be explored to any significant degree. Learning today is presented either as scheduled – in which case the institution sets the time – or static, in which there is no scheduled time. The use of syndication technologies, however, creates many more alternatives. A learning resource, for example, can be defined either as an ongoing syndicated service – such as my own newsletter, or the audio feeds distributed by SpanishPod – or as a staggered distribution of resources, such as have been designed by Tony Hirst of the Open University. (Hirst, 2006)

Being able to time the distribution of resources is a significant advantage. It allows for presentations, interactions and other activities to be encountered dynamically during the course of days or weeks. This space can be used to pedagogical advantage in addition to

meeting the student's scheduling needs, facilitating ongoing practice and recall. Dynamic scheduling does not guarantee success – students may simply delete the material as it arrives. But having this level of control makes it more likely students will be able to attend to the material when it arrives.

Self-pacing in online learning, therefore, isn't simply the learner picking up the work from time to time whenever he or she feels like it. It is rather the employment of various mechanisms that will enable work to be scheduled. Pacing continues to be important, even in instances of self-pacing. Being free to set one's own schedule does not mean setting no schedule at all. Nor does it mean that the release of learning activities and content is not scheduled at all. It is, rather, a meshing of schedules.

One of the major reasons Microsoft Outlook continues to maintain a high level of use and acceptance is that it combines content – email messages – with calendaring. Products like Google calendar, Thunderbird, and evolution are slowly eroding Microsoft's monopoly, and the employment of standards like iCal mean that events, like contents, may be syndicated. (Shah, 2005) This allows events and syndicated contents to circulate within the same network, creating an association between time and content that is dynamic, fluid, and distributed. It will allow students to plan their days, and it will also allow them to participate, on impulse, in learning activities, via their RSS Events Reader.

Place Independence

Online learning still suffers from the misperception that it is about having students sit in front of their computer screen for extended periods of time. As a consequence, the idea that online learning might foster independence of place has been missing in much of the discussion of the field. Nor is current practice likely to change this, as we see online learning used to support *in situ* classes, and online learning consisting of long sequences of computer-based lessons.

This is unlikely to be the case in the future. "Students are no more likely to sit in front of a computer for all of their instruction than they would be to sit with one of Skinner's programmed learning machines." (Morrison & Lowther, 2007) With the recent development of smaller and lighter wireless-enabled devices, we are approaching the era when online learning will also be seen as mobile learning. Students will be freed from the classroom, and freed from the stationary desktop computer. And as I said last time, true place independence will revolutionize education is a much deeper sense than has perhaps been anticipated.

In order to realize this potential, educators will once again need to get past the idea that learning is something (usually content) that is *delivered* to people. This is the model that prevails in traditional distance education, and in contemporary online learning. (Herrington, Reeves, & Oliver, 2005) Content is delivered as a quantity of reading and browsing material. Teacher presentations are delivered as audio or video recordings or lectures. And even other students are delivered through some sort of conferencing systems. This model – of *delivery* – has had the effect of binding the student to the

delivery platform, whether it is a computer, telephone, teleconferencing facility or ITV classroom in order for instruction to occur.

As we are now beginning to see, personal access devices (ranging from mobile phones to lightweight laptops) are highly portable. And this has the effect of changing the behavior of people who use these devices. Consider how the mobile phone revolution has shaped a generation. (The Guardian, 2005) People remain highly connected, perhaps more so than ever, but now any location can be used to connect (so much so that we actually require legislation or social norms requesting that people *not* connect in certain circumstances, such as while driving or while watching a movie). (Ferguson, 2008)

As the capacity – and functionality – of mobile devices increases, the activities they support also become highly mobile (and much more widely distributed across society). People now listen to music or audio recordings wherever they are. They take photographs more than ever, so much so that 'no camera' bans in museums and rock concerts are unenforceable. Video recording is now commonplace, and video cameras, it seems, are everywhere, recording everything from baths in restaurant sinks to a teacher mooning the judges at a debate.

There is, of course, no reason why learning cannot be one of the many mobile activities now possible, but this transition will occur more slowly, as designers realize that, instead of *delivering* content to the student, they can require the student to go out and *get* it – or even better, to go out and create it. (Sener, 2007) Once we understand that learning can and should occur outside the classroom, it will become commonplace to see students engaged in learning activities throughout the community. Instead of being rare events – such as the way student create newsletters at teacher conferences in Saskatchewan – these will be commonplace events.

And it is important to understand that place independence means that real learning will occur in real environments, with the contributions of the students not being some artifice designed strictly for practice, but an actual contribution to the business or enterprise in question. We sometimes think of people today 'learning on the job'. In the future we should also think of students 'working at school'. We are already seeing cases of this, from the business Teemu Arina built in Finland to the Chaos Pilots in Denmark to the Collaborative Open Environment for Project Centered Learning (COOPER) project in Holland.

It is worth mentioning at this juncture a different sort of place-independence: cyber place-independence. Current online learning efforts are based on the idea that learning will occur in a certain online place – a learning management system, say – or will be conducted using certain software tools. This is a trend that will erode as students' capacities increase and web resources and services are available inside other website or applications. Independence of online place will be as important to the future of online learning as will be independence of physical place.

The School of the Future

Today's school, even now, is dominated by classrooms. True, some of those classrooms now contain computers, but the design remains essentially one where students assemble in a room to focus on dedicated learning activities, usually in the form of some sort of content delivered by a teacher. Though there have been challenges to curriculum over the last ten years, the basic structure of curriculum has not changed, and indeed, has in some places become more entrenched, as schools focus on a return to basic subjects.

The school of the future depicted ten years ago therefore remains rooted in the future, a vision toward which some educators may aspire, but today something that we can only anticipate.

That said, much of the *learning* that is happening in today's schools is beginning to resemble the sort of learning that one might expect in a connected environment. Student-centered methodologies are becoming widely accepted in many nations. In particular, constructivist pedagogies are being implemented in some e-learning technology, such as Moodle (Moodle, 2008) and adopted by some systems, such as in the province of Quebec, Canada. (Cobb, 2005)

As learning evolves slowly from a classroom-based and deliver-based type of instruction, and toward wide-ranging learning activities that are largely selected and managed by the students themselves, the dedication of space in schools to classroom instruction will be reduced. Instead, schools will be converted into meeting facilities, workrooms and laboratories, multimedia studios, and more. Specialized equipment, such as sound-proof recording studios and high-speed video editing equipment, will be made available. Libraries will evolve (in a transition that is happening today) into multimedia studios, where students engage with interactive media, games, and other types of content. VR rooms, such as the CAVE, will be constructed, emulating the simulation environments that police and military use today. (Jones, 2005)

Schools of the future will change and diverge; where once we saw identical red-brick schools in every community, now schools of every size and shape will be developed, as public school boards begin to recognize that diversity and choice are strengths. A good example of this already is the Edmonton school board, where learning opportunities vary from the traditional large school, Harry Ainley, in the suburbs, to the alternative downtown Central High, to schools based on culture and faith and even hockey. (Downes, Options and Opportunities, 2008)

Convergence

The changes we will see in learning will not occur as a result of one type of learning replacing another, but rather, will result from a gradual convergence between the different forms of learning.

This has already begin to be seen in what is today called *blended learning*, which is essentially traditional in-class learning supplemented by online activities and resources. A blended learning opportunity, for example, may consist of one in-person class per week instead of three, with online conferencing and reading replacing the rest. Or it may consist of a capstone conference session following several weeks of online work.

As convergence takes root, and as learning becomes more distributed, the focus of such learning opportunities will change. Blended learning is typically rooted in, and centered on, the in-person activity, making it difficult and less-satisfying for people in remote locations to participate. (Dziuban, Hartman, & Moskal, 2004) Improvements in conferencing will make actual in-person meetings less necessary, and the 'blended' aspect of blended learning will come increasingly to reflect the in-person activities people undertake in their own workplaces or communities.

The convergence of digital life with in-person life is not, therefore, a mere addition of a digital dimension to the in-person life we lead today. It transforms and reshapes that life, removing from it elements that could be done more efficiently (or more pleasantly) in a digital environment, and opening up opportunities for new and more types of in-person activities. While before, for example, a field trip to a local stream or forest would be seen as a once-a-semester activity, because it would otherwise consume too much class time, it could now become (for some students) a once-a-day activity, with what used to be classroom activities designed around the field trips.

Additionally, education will be increasingly supported through multi-use community centers. These will be available to students and parents alike, there being no need to limit community learning to the young. Facilities such as the Living Arts Centre in Mississauga, where students of all ages can create pottery and sculpture, practice ballet, work on glass blowing, and many other arts, will become commonplace.

We should also look toward the development and deployment of learning facilities in traditional working environments. Students of all ages will be able to learn about law in learning facilities made available at courtrooms. Galleries at legislatures and town council meetings will be equipped with internet access (of course) and supported with installed facilities for learning and visualization (such as, say, a zoomable hologram of the city, allowing members and visitors along to see zoning changes and planned construction). Farms and greenhouses will employ student workers, who will study and catalogue plant and animal life as they work with it.

Learning Communities

Education is not merely the acquisition of new information and skills. To become educated in a discipline is to learn the habits, patterns, ways of thinking and ways of thinking characteristic of that discipline. (Ramaley & Zia, 2005) Consequently, learning is a social activity, wherein we immerse ourselves into what Etienne Wenger called a

community of practice (Wenger, Communities of Practice: Learning, meaning and identity, 1999), learn what Michael Polanyi called tacit knowledge (Polanyi, 1962), and be able to complete, as Thomas Kuhn famously summarized, the problems at the end of the chapter. (Kuhn, 1962)

Although we learn what we learn from personal experience, we usually learn what we learn *from* other people. This learning is ongoing, from the day we open our eyes as a baby and see our parents, through school as we play in clusters on the playground, in college or at work not merely in the classroom but also (and mostly) through social activities, clubs, the local pub, and our friends. It is typically a social activity, where knowledge and skills are demonstrated, criticized, or merged.

Ten years ago, I argued that online learning in the future will emphasize community much more than is perhaps imagined today. At the time I was thinking of discussion communities, as described by Cliff Figallo (Figallo, 1998), and portal websites, as described by Hegel and Armstrong. (Hegel & Armstrong, 1997) The internet more than delivered, sustaining not only these but a wide array of online communities and social networks, the significance of which is just beginning to be understood today.

At the time, I emphasized two major types of communities relevant to online learning: interest-based communities, and peer-based communities.

Interest-Based Communities

Today we would use the label ‘communities of practice’ to label ‘interest-based communities’, or as I also called them, ‘topic-based communities’. And while that would be an accurate description, to a certain extent, it is also a bit too narrow for the concept I had in mind.

Interest-based communities were and are relatively easy to identify on the internet. Erin Brewer described a prototypical interest-based community when she described the community that formed around the activity of bee-keeping on Yahoo groups. (Downes, Principles of Resource Sharing, 2004) Such communities, especially in the earlier days of the internet, were the dominant form of organization online.

Wenger’s characterization was informative. Communities would form around a topic of interest – the ‘domain’. They would engage in community activities – “members engage in joint activities and discussions, help each other, and share information.” And they would share a practice – a repertoire of resources, a vocabulary, common stories, common methodologies, common ways of approaching a problem. (Wenger, Communities of practice: a brief introduction, 2004)

Learning in the community of practice takes the form of what might be called ‘peer-to-peer professional development activities’. Rather than formalized learning, members help each other directly. We discovered this in Alberta when we studies how professional

town managers learn: we discovered they call each other up on the telephone. (Stefanick & Lesage Jr., 2005)

And as Wenger says, "From this perspective, the school is not the privileged locus of learning. It is not a self-contained, closed world in which students acquire knowledge to be applied outside, but a part of a broader learning system. The class is not the primary learning event. It is life itself that is the main learning event."

Although the communities themselves didn't develop along the model postulated by Hegel and Armstrong, communities did nonetheless form. The use of search tools such as Google made this inevitable, as any person interested in a given topic would search for it at some time or another, thus encountering the online presence of any other person who was also interested in the subject. Today, for just about any given topic, some community of some form exists.

Peer-Based Communities

People have friends in the physical world. Such friendships are arguably necessary, and they are certainly common. They form the basis of romance, the seed of personal relationships. They are the touch, the part on the back, the shoulder to lean on, the drinking buddy, the opponent on the golf course. They are the people we know, as we would say now, "in RL" - in real life.

As I noted in 1998, peer-based communities are almost the polar opposite of interest-based communities. They are not based on some common interest; one member may be an artist while the other may be a scientist. In the first instance, they are created through proximity, being composed of people who live in the same neighborhood or who go to the same school. Over the longer term, we may say, they are just people who meet by happenstance, and find an affinity for each other.

Such communities were almost non-existent on the web ten years ago, and at the time I treated them as almost entirely offline communities, characterizing them as the circle of friends you would meet at the local learning center or the local recreational center where you took your online courses or engaged in some other activities.

Thus I cited the community learning centers I worked at at the Canadian north - the learning centre in Fort St. Jean, in northern British Columbia, shown to me by the people at Open Learning Agency, or the fishers' retraining centre, a block away from the urban aboriginal training centre, fostered by the New Westminster School Division. Or the South West Indian Training centres in Sioux Valley and Waywayseecappo, in rural Manitoba.

But it was perhaps inevitable that these communities would also establish themselves online. Indeed, the secret to the rise of Facebook, which rose to prominence in a short time, and which now has the most traffic of any site on the internet, is that it formed connections between friends based on their common origins and common schools (when

it launched, it went so far as to block members who were *not* members of these community groups). (Stutzman, 2006)

The rise of social networks on the internet is a reflection of this pattern, the creation of communities online based on affinity rather than on commonality of interest. Friendster, Tribe, Orkut, MySpace – they all walk that fine line between brokering relationships online and establishing some sense of exclusivity, of clubbishness. In this way they achieve some of the sense of personal connection that existed in earlier, non-professional, online communities, such as The WELL.

People will continue to use the internet to connect not only with the people in their professional lives, and not only with people who share topics and objects of interest, but also people in their personal lives, people they see every day and could talk to across the room if they wanted. But because of the problems with social networks – the lack of privacy, the lack of control over identity – we may see a return to the more private and exclusive online community. The trick, though, will be to allow people in these communities to communicate with each other across communities.

Learning Communities

Strictly speaking there is no such thing as a 'learning community' – save, perhaps, the strained and artificial creations of educational institutions that try to cram classes into collectives, creating personal relationships where none naturally exist. Rather, people learn *in* communities, and what would make any given community a 'learning' community or otherwise is whether people in the community learn more or less well.

It is probably a truism today (though there still remain exceptions to be observed online) that communities are *grown* rather than constructed, and that (therefore) they are owned (and managed) by their members rather than by some external agency. Sharing and learning cannot be "legislated into existence." (Dube, Bourhis, & Jacob, 2006) The desire for autonomy comes part and parcel with some of the perceived benefits of learning and growing in a community: safely, security, and privacy.

In the field of learning especially, there is a great deal of attention paid to what it is members have in *common* that facilitates the creation of a community – whether it be common educational needs, common age or locale, common sets of values, or even more theoretical entities, such as common objects, domains of discourse, or understandings.

The value of a community, however, and especially of a learning community, comes from the *diversity* in the community. Students gather around an instructor precisely because the instructor has knowledge, beliefs and opinions that the students *don't* share. They gather around each other because they each have unique experiences. Fostering a learning community is as much a matter of drawing on the differences as it is a matter of underlining the similarities.

It is probably most accurate to say that there is no single design of a community that works best for every group of learners and for every domain of learning. The sort of community that you would want for an eight-man rowing crew is very different than one you would form to create a philosophy discussion circle, and different again from the sort you would create in order to learn a new language.

What will work best online, therefore, will not be a process of community *building*, but rather, a process of community *enabling*. The transition in community is therefore analogous, and parallel, to the transition in content. Just as people no longer need publishers to create content for them, they no longer need organizers to create community. Rather, just as, with access to powerful content-creation tools, they can create their own content, in the same way, with powerful community-building tools (such as, say, Ning) they can create their own communities. (De Rossi, 2007)

This is what we have seen online thus far. The tools people have used have been varied, ranging from the complex and powerful, such as Second Life, to the simple and almost ephemeral, such as Twitter. In all cases, the role of the tool was to create a space – virtual or otherwise – in which people can communicate, and then the members built the rest.

The creation of learning communities will work in much the same manner. Despite the efforts of educators and individuals to create (often lavish and complex) learning environments for students, this will in the long run not be necessary. Learners will create their own communities, their own environments. At most, the educator needs to ensure that the tools are there for students to use, and that the channels of communication, from student to student, from community to community, are open.

Identity-Building

It is worth noting that theorists of both professional and social networks speak of one's interactions within the community as a process of building, or creating, one's own identity.

Wenger, for example, writes, "Having a sense of identity is a crucial aspect of learning in organizations. Consider the annual computer drop at a semiconductor company that designs both analog and digital circuits. The computer drop became a ritual by which the analog community asserted its identity. Once a year, their hero would climb the highest building on the company's campus and drop a computer, to the great satisfaction of his peers in the analog gang. The corporate world is full of these displays of identity, which manifest themselves in the jargon people use, the clothes they wear, and the remarks they make." (Wenger, 1998)

And meanwhile, danah boyd, studying the social community, writes, "The dynamics of identity production play out visibly on MySpace. Profiles are digital bodies, public displays of identity where people can explore impression management. Because the digital world requires people to write themselves into being, profiles provide an opportunity to craft the intended expression through language, imagery and media.

Explicit reaction to their online presence offers valuable feedback. The goal is to look cool and receive peer validation. Of course, because imagery can be staged, it is often difficult to tell if photos are a representation of behaviors or a re-presentation of them." (boyd, 2006)

In both of these we are seeing aspects of the same phenomenon. To learn is not to acquire or to accumulate, but rather, to develop or to grow. The process of learning is a process of *becoming*, a process of developing one's own self.

Accordingly, what we know of the communities of the future where learning will actually occur is that they will be communities in which learners can immerse themselves and grow into something new. Previous experience suggests that these will be places where they can create and where they can project – not "serious games" but "modding communities", not "reading groups" but "fan fiction", not "educational simulations" but "LAN parties".

The Triad Model

The model of community described in the previous section suggests a natural organization of services and resources, one I tried to capture under the heading of 'the triad model'.

The Triad

The idea of the triad model is that in any given learning situation, there are three major participants: the student, the instructor, and a local coach or facilitator. The concept was current in 1998 and was being fostered by organizations such as the Oregon community college network. The idea was that the instructor would be online, a member of the interest-based learning community, while the coach or facilitator would be more a member of the peer-based community. (Baker, 1998)

These elements have persisted and will persist in any description of online learning, though over time their description may be refined to reflect actual practice.

Online, for example, we would expect not only to find the instructor and any administrative services, but also resource libraries, other students, and digital tools or platforms on which distributed work may be performed. The online component of a person's learning environment will tend to me more distributed, based on communications and connections of a cognitive nature.

Offline and locally, by contrast, we would expect to find not only coaches and facilitators but also one's immediate friends and family. We would also expect to find local facilities, along with facility managers and other support staff. The offline component of a person's learning environment will tend to be more localized and immediate, based on personal relationships, support and emotional attachment.

Typically, the role of the online environment is to inform and assess, while the role of the local environment is to reaffirm and to advocate. These, obviously, are generalizations, and crossovers are likely – we may take some tests in person, and we may form some emotional attachments to online groups. But these will be the exception rather than the rule.

Probably the most significant (and as yet unrealized) aspect of the triad model is the idea that some local authority figure will act as an *advocate* for the student.

The Online Host-Provider Framework

Societies continue to work out the process of managing digital and physical resources. That said, the framework described here remains probably one of the more accurate – and more likely – descriptions.

The 'host' in this framework corresponds to the local and (mostly) non-digital component of a learner's environment. This would be the agency that managed the physical facilities, connectivity, coaching or mentoring, and other local services.

These are roles that are typically undertaken by a community, school board or a local government. In the corporate world, this will be the learner's company or department. These are the agencies that focus on provisioning and supporting, the agencies that would have the most interest in fostering *learning*.

The *provider* framework, however, is a network of agencies and services that manage the distribution of software, content and services to a wide area. The provider typically operates at a remote location, and might be a national government, university or institution, telecom company, software company or publisher. These agencies provide services, but act based on interests of their own, the government having social polities it wants to fulfill, the institutions seeking to satisfy their board members, funders or shareholders.

We are seeing increasing activity on the 'provider' side of the equation, as institutions and agencies set up repositories and online services. Projects such as MIT's OpenCourseWare and Rice University's Connexions are examples of this. Commercial media are also in the mix, with services such as CiteSeer providing front-end search results for institutional access into publication archives.

Significantly less work is being done at the 'host' level, partially because it's more difficult and partially because the services provided require little more than passive consumption of learning materials. Over time, local agencies will become more pro-active, seeking out and supporting more interactive and more engaging forms of learning. No longer content to be a passive recipient of learning and culture from distant places, the local community will expect to be an active participant in the learning experience of its young.

Accreditation

In 1998 I wrote that "The mishmash of host institutions, provider institutions, and umbrella organizations is going to result in an increasing debate over standards and testing. It is going to get worse before it gets better. It probably won't get better."

In 2008 we finish a decade that has seen controversial legislation such as No Child Left Behind, the rise and fall of numerous 'virtual universities', ongoing debates about the results of independent testing (such as OECD's PISA tests (OECD, 2008)), commercial educational ventures (including the controversial Edison schools in the U.S. (Saltman, 2005)), charter schools, vouchers, digital diploma mills, off-shore institutions, and more.

In the years to come, we will say that it was a quiet decade, with the existing system having remained largely unchanged, almost unsuspecting even, of the major changes that were to follow. And as it stands, the monopoly on degree-granting status largely remains in the hands of traditional institutions. But nobody can expect it to remain there.

The Divergence of Learning and Testing

It hasn't happened yet in any large scale and formal way, but it is probably inevitable that the domains of 'learning' and 'testing' will separate. In the future it may even be thought of as quaint that those responsible for the fostering of learning were also those responsible for evaluating whether or not learning actually happened.

The model of assigning testing to independent testing agencies is already the norm in some industries. Car drivers and airline pilots are evaluated by independent agencies, as are lawyers and accountants. Software engineers are certified by software agencies, not their teachers. And of course anyone involved in professional sports or entertainment is evaluated in competition in the arena or the marketplace.

In traditional learning there is slow acceptance that people may be tested without first having been taught. Colleges and universities are investigating 'PLAR' (Prior Learning And Recognition) systems. (CICIC, 2008) People who are in some way able to demonstrate their ability – through a portfolio system, for example, are able to circumvent the need for testing altogether.

This is a trend that will continue. As it becomes more and more possible to teach oneself online, and even to demonstrate one's achievement through productive membership in a community of practice, there will be greater demand for a formalized system of recognition, a way for people to demonstrate their competence in an area without having to go through a formal program of study in the area.

The university degree is a designation of considerable weight and *cachet*, and so it is probably going to remain in use. What a degree stands for, however, will change, as

institution become more willing (after much arm-twisting) to recognize educational achievements from a wide range of providers, including testing agencies, as constituting part, or even all, of the degree.

What will spur this sort of development is an 'open achievements API' - that is, a way to syndicate qualifications information. Qualifications will be displayed by the institution granting them - but only (?) with the permission of the person being granted the qualification. This is one of those innovations that would have wide-ranging consequences, as institutions would (very suddenly) come to be evaluated according to the students they qualify. It's a space a tough independent testing agency could make a name for itself. (Hirst, Time to Build Trust With an "Open Achievements API"?, 2008)

Education as a Service

As the provision of educational services becomes more commercialized, the representation of education as a *service* will become more pronounced. The idea is that the student will be viewed more as a *client* than as an apprentice, a person to be served more than an acolyte to be judged. (Knight, 2006)

The emergence of education as a service will accelerate some of the trends highlighted above. One of the major drivers for independent (or 'standards-based') testing is the expected diversity of educational providers. Commercial services need governmental oversight, and that is the sort of service independent testing provides. Moreover, service-based education will push the emergence of the 'provider framework', as described in a previous section, and consequently the more community-based host framework, as a balance to that system.

Why would we move in such a direction, given that it creates such a complex structure, and carries with it so many risks? Why not keep the system we have, where government agencies, such as schools, provide the bulk of teaching and testing?

Economic pressures will prevail. On the one hand, providing education through schools is an expensive process, requiring a great deal of staff labour. Even today, some governments resist the sort of expenditures that would be required to fund all students equally, and for less wealthy nations the idea of a fully-funded school system is just a pipe dream.

On the other hand, online learning offers an inexpensive alternative – but only if it is deployed using less labour-intensive practices. Simply replicating the offline experience online does not save money; rather, we see reports that it becomes *more* expensive. (Twigg, 2000) (Carr, 2001) Online learning, if it is to offer economic advantage, must be based on the idea that learners are able to provide for their own learning, using both resources provided by educators, and by assisting each other through collaborative networks.

Consequently, educators, rather than engaging in the traditional practice of *directing* education, will instead focus on providing educational services into *self-directed* networks of learners.

Accreditation and Reputation

The purpose of accreditation is to ensure that the statements asserted by credentials – that a person, for example, has mastered the art of dentistry – are true. (Holmberg, 1997) To this end, the institutions that issue such statements are vetted. Accreditation agencies examine the process employed in the production of such statements, and if the process meets a set of standards, we can be reasonably sure that the statements are true.

A more informal process governs the selection of institutions by students, that of the reputation of the institution. The reputation is influenced by a large number of factors, including brand recognition, word of mouth and proximity. The mechanism employed by prospective students is much less reliable, especially insofar as it is informed by advertising.

Neither process will be effective in the new environment of distributed educational resources. If the delivery of learning is separated from testing and certification, there will be a proliferation of learning agencies (and, potentially, a proliferation of testing agencies). Because the barriers to entry in the market are low, the consolidation of the industry will be slow, if it occurs at all. We see this in less rigidly regulated markets, such as Bogota, where there is more than a hundred universities (Wikipedia, 2008).

What will emerge for learning institutions, as for most other services, is a system of reputation management that is integrated into the search process. *Recommender systems*, as such systems are now called, will employ pattern-matching software to find resource providers for potential clients. (Herlocker, Konstan, Terveen, & Riedl, 2004) The software will draw information from a wide range of other services, including information about the institution that produced the resource.

The Google search algorithm is an early example of a recommender system (Zhang, Medo, Ren, Zhou1, Li, & Yang, 2006), employing as it does information about what people link to in their web pages and what people talk about in their mail to give each resource a ranking. Google additionally tailors those rankings to profiles it creates of its customers. Personalization is at the core of recommender systems; what counts as 'the right resource' varies from person to person, from time to time.

In the same way, testing agencies will also acquire a reputation over time, this based largely on assessments of people it has tested. People seeking to establish a set of credentials for themselves will likely rely on a number of different testing agencies in order to mitigate the risk of being certified by a poorly ranked agency.

But that said, as more and more of a person's life becomes available online, the need for certification will diminish, as people acquire reputations of their own. A person's

standing in a community can be recognized by members of that community, and is acquired through months and years of participation in the work of that community. Where certification is granted, people presenting certification *without* having acquired a reputation for work in the community will be viewed with suspicion.

We are seeing today how people can acquire a reputation without having achieved formal credentials. Some of these reputations are fleeting, such as the fame that accompanies the production of a popular YouTube video. But some are more permanent, such as those of the people who built Firefox (and were later hired by Google). We are also seeing the same phenomenon with institutions. Some sources – Internet Movie Database, say – are widely trusted. And others, such as Brainbench, are working to establish a name for themselves.

As we have seen, though, with search engine optimization (SEO) and other attempts to mislead reputation systems, there will continue to be a tension between the trust we put in such systems and the degree to which they can be infiltrated or corrupted. (Wu, Goel, & Davison, 2006) Reputation systems based on data that *can't* be replicated or imitated will acquire the most trust, and these will most likely be based on verifiable identity and interactions within social networks.

Modularity

A History of Modularity

When the concept of the 'learning object' was proposed, a large part of the idea was based on the idea that these small chunks of content would be fitted together to form larger entities. "Like Legos," said some proponents, describing the way the objects would use a universal interface to fit together. (Wiley, 2002) In 1998 I described this idea under the heading of 'modularity', the idea that an entity we consider to be a single unit is in fact composed of separate and independent parts.

As Legos demonstrate, modularity works very well in some contexts. Most complex objects are composed of separate - and exchangeable - parts. Computers, electric trains, aircraft - all of these are modular to a degree. But the interface is hardly universal. As David Wiley noted after a few years of practice with learning objects, other analogies might be more appropriate - that of the atom, for example, where some parts may fit some other parts, but not all parts fit all other parts.

In the years that have passed, specifications, such as Content Packaging and Simple Sequencing, were designed to facilitate the creation of larger entities out of smaller entities. But the idea of making large content entities out of smaller and reusable content entities began to be challenged. In 'the reusability paradox', Wiley questioned the idea. (Wiley d. , 2003) For content to be usable, he argued, it must be very specific to a context. But if context is very specific to a context, it is not reusable.

It is too early to suggest that the idea of reusable modular content is incorrect, if indeed it ever was incorrect. But Wiley's observations, along with a deeper look at the analogy

from mechanical parts, shows that reuse is rather more complex than the mere connection of digital objects together. For even in the physical world, where reuse is common, different types of parts fulfill specialized roles. Screws, for example, are generally reusable, if you want to attach things, but come in various sizes and shapes, for different purposes.

In the world of digital content, too, the concept of 'fitting together' proved to be more complex that a mere plugging of one bit of content into another. It became clear that the learning management system would need to be able to exchange information with the learning object – to send to the object, for example, the student's name or grade, and to retrieve from the object, for example, test or quiz results. In the Sharable Courseware Object Reference Model (SCORM) this was defined by means of what was called a 'wrapper' - some computer code that accompanied the object and facilitated this interaction. In practice, interactions tended to be specific to the system the learning object was defined for, so the objects, while technically SCORM-compliant, could not always be reused on other systems.

Using Modular Content

To support the use of modular content, I argued ten years ago, we would need two types of technology: first, distributed design, which would allow courses to be made up of components located all over the internet; and second, educational object repositories, which would facilitate the creation and storage of digital content for later reuse. Though we saw the educational community develop the latter, instructional technologists did not embrace the idea of distributed design.

Several technologies emerged to support resource repositories. Most formally, institutional or enterprise content management systems, such as SiteScape, were used to support collaborative development. Proponents of open access developed the open Access Initiative (OAI), which defined a set of protocols for uploading, searching, and retrieving resources. The MIT DSpace project built on and expanded the OAI protocol. (Branschofsky, Lubas, Smith, & Williams, 2003)Meanwhile, more or less public archives sprang up on the open internet, sites such as the internet Archive, Flickr, YouTube and box.net.

The educational community, however, saw the repository as something that would be housed and managed locally. This led to the development of the Learning Content Management System, which combined the functions of the LMS with those of the CMS. (Nichani, 2001) The idea was that learning resources might be obtained remotely, but would be stored locally, in what was essentially an institutional library. Proponents of this model argued that local storage was necessary to ensure reliable access, consistency and persistence. (Chapman, 2007)

This is an argument that makes sense when reusable content is being used to construct static and asynchronous courses. As the use of learning resources becomes more dynamic, however, the extra steps required in order to obtain and store locally external

content become more onerous. In the long run, a mixture of approaches will be used. Material will be *sourced* externally – it won't make any sense to restrict one's search to a local library – and insofar as local copies are created, this will be done automatically.

For this reason, much of the work on learning objects has been based on indexing and discovery. Some repository specifications require support for a search function, and cooperating repositories typically support what has come to be known as a search *federation* – a single search will be executed simultaneously across a number of different libraries all at once. Such searches were supported and assisted through the use of metadata data and keywords – an instructor, say, could search only for 'history' texts, or only for material at the 'grade 8' level. (OSTI, 2008)

Educational Object Protocols

It is worth saying a few words about educational object protocols, which I predicted ten years ago would play a major role in educational technology. While this prediction has come to pass, the evolution of such protocols – now known as Learning Object Metadata (LOM) and associated standards – has not been smooth.

As I later argued in my paper Resource Profiles (Downes, Resource Profiles, 2004), LOM should not attempt to be all things to all people, and should focus solely on the *educational* properties of a resource. Moreover, I argued, these educational properties are not identifiable *a priori* in the resource itself, but rather, are defined over time through *use*. Consequently, instead of designing LOM as though it were a bibliographic record – which was the practice of the educational technology community – LOM should be integrated with and used with other specifications and standards, forming part of a larger, and more dynamic, resource profile.

What we have seen of web technology as a whole suggests that this is the course that will be taken. A single metadata file – a Dublin Core resource description, for example – now links to external vocabularies, rights declarations, and other metadata. Moreover, metadata created through use, sometimes called attention metadata, is now being merged with bibliographic metadata. And global search sites, such as Google, use their own internally created contextual metadata (such as link information) to organize search results.

Additionally, specialized metadata and communications protocols are being developed to allow applications to communicate with each other. Web pages are able to send information back and forth to web servers using a set of protocols called AJAX (Asynchronous Javascript and XML) while web servers communicate with each other using REST (REpresentational State Transfer). (Garrett, 2005) These protocols form the heart of what is now called Web 2.0, and though it is likely that the specifications will evolve over time, the functionality created through the use of these specifications will persist. We have now, permanently, entered the age of the connected, distributed, web.

Standards and specifications will continue to form an important and central role. They are the syntax of the web, defining how the parts – whether bits of content, or bits of applications, or people and content, or whatever – fit together. They will evolve dynamically, come into and fall out of currency, be constantly changing, constantly evolving. It is tempting to think of such a system as broken, and to attempt to try to fix it. But the system is not broken – this is how it works. It is a dynamic, flexible *changing* system that makes learning possible at all both in individuals, and in society as a whole.

Modularity, Continued

The original picture of modularity resulted in a vision typified in SCORM, where an individual learning object would communicate simply with a learning management system. The learning object would thus become a part of the larger whole, and no other interaction would be necessary.

There is still a lot of work being done in the area of modularity and to a certain degree - generally within a single enterprise or institution - some reuse is happening. Accompanying this work, however, is a general reduction of the size of a given unit of learning. Where a 20 or 40-hour course may be appropriate in an in-person learning environment, shorter courses are more appropriate online, as short as ten or fifteen minutes. (Kucsera, Zimmaro, & Trivedi, 2008)

Various reasons have been proposed, from the shorter attention span of the student to the difficulty of reading text online. It is arguable that the shorter course becomes necessary online because the online learner wants and expects more control over his or her workload or schedule. Once we have the idea of dividing learning into self-contained units, it may be argued, there is no reason to arrange them in certain pre-defined ways. Why not allow the learner to arrange them in the ways that make the most sense to them?

Modularity, as seen from this perspective, takes the idea of a learning object communicating with a single LMS, to form a single course, and multiplies it, allowing a single learning resource to communicate with multiple entities, to form parts of multiple courses, all at once. The same resource may be part of a game, part of a performance support system, part of a desktop. It is a tool, that is used by the learner where needed, or it may be something a learner has created using a tool (there is no logical distinction between them). It a library, referred to when wanted, or a work in the library, that the learner is currently authoring. It is a desk drawer, filled with notes, drawings, or whatever, or some of the contents of that drawer, to be pulled out and used – as a tool, a library, a drawer (our categories of 'objects' break down when we are thinking digitally).

This is a different take on the idea of re-use. While the traditional conception of learning objects was that designers or instructors would assemble smaller chunks of content into coherent presentations of learning material, this is rather the idea that the management of re-use would be placed directly into the learner's hands, so that reuse could occur, not simply within a course content, but in any context where re-use makes sense.

In this way, the reuse of learning resources is consistent with the sort of reuse we see happening elsewhere on the internet. Rather than being structured to form larger wholes, individual bits of content are being remixed and repurposed to form new content objects, (Downes, e-Learning 2.0, 2005) and these content objects are being used in what amounts to a rich multi-media based conversation. From the perspective of the learner, the learning resource is like a YouTube video or a Flickr image or any other type of content: something to be shared with friends and used to express ideas and points of view.

None of the metaphors, such as Legos or atoms, describe this version of modularity appropriately. I once used the metaphor of *objects in an environment* – like a horse and a palm tree – to describe modularity. Objects are not designed for each other, nor do they fit together in any particular way – they coexist in the same space, and each perceives the other in its own way. They share, if you will, the same *information space* – the palm tree reflects light waves, and the horse sees them. The objects function autonomously, connected, interacting, but not joined.

Technology of the future will consist almost exclusively of such autonomous objects; even our large systems, such as learning environments, are best thought of as autonomous objects that interact with other objects.

Copyright, Ownership and Identity

As expected, issues of copyright in particular and intellectual property in general have played a major role in online learning over the last ten years. This trend is likely to continue, but with a gradual easing of the sort of logjam that has stymied innovation and development in the field.

Roadblocks

Probably the most visible impact of copyright on higher education over the last ten years has been the series of lawsuits launched against students (and concordant threats against universities) over the sharing of digital music files. (Bangeman, 2007)

What used to be an analog and inefficient process suddenly became easy and mainstream using digital technologies. And consequently, a private and non-commercial activity became the focus of business models for companies like Napster and Kazaa. At the same time, publishers sought greater control over distribution, seeking to license, rather than sell, content and software.

This prevented instructors from replicating online practices common in the typical classroom. No longer could newspaper clippings, articles or textbook chapters be distributed as handouts. No longer could video clips be shown or audio recordings be played to the class. The digitization of academic content was, at every turn, challenged by publishers. (Guess, 2008)

In like manner, the use of educational software became a complex and expensive proposition for educational institutions. The cost of educational software rose, mergers and lawsuits limited competition, and customers were locked in to existing vendors by proprietary technology and the cost of conversion. “Many customers feel that these price increases are not warranted or feel that they would like to be more in control of the LMS functions they wish to offer on their own campuses.” (Reisman, 2006)

And in some areas, innovation ground to a halt as a result of patents and lawsuits. Probably the most visible case is that of digital rights management itself. Holding a broad swath of DRM patents, ContentGuard stood poised to threaten any company trying to develop a rights declaration system. But in the absence of any actual lawsuits that might define the scope of the patents, and of any effective technology from ContentGuard itself, work in DRM has remained stalled. “So long as the relevance of ContentGuard patents is sustained in all standards environments, the effective monopoly of ContentGuard on DRM is achieved.” (Cover, 2006)

The argument in favour of strong intellectual property protection is that it fosters innovation. But our experiences over the last ten years show the paucity of such claims. (Timmer, 2008) The areas in which innovation has been fastest have been areas in which no effective patents held sway – HTML, CSS and Javascript, content management and syndication.

Where strong IPR exists, in areas such as online textbooks, digital rights management and wireless technology, say, innovation has been agonizingly slow, with new products and services being unveiled at glacial speed, at significant cost. Sometimes – as we saw in the case of inexpensive laptop computers – the market opens up only in response to an open or non-profit initiative. (Goth, 2008)

Since rights holders are not likely to lose their influence over policy makers or over the market, this asymmetrical pace of development will continue. Over time, and as a general rule, non-encumbered products and services will gradually come to dominate the marketplace. However, this process will not be uninterrupted, as commercial developers are capable of considerable innovation themselves. For every Apache, we are likely to see an iPod. For every Firefox, we are likely to see a Spore.

Responses

While court cases, protests and defiance have garnered the headlines, the most overwhelmingly popular response to proprietary content and technology has been the fostering and creation of free and open alternatives. Free and open source software, as well as free and open content, have both been made possible through the development of licenses prohibiting the enclosure of such work in proprietary media. These licenses have been defended successfully in court. (Kirk & Montalbano, 2008) (Rowe, 2008)

As a result, proponents of strong intellectual property regimes have been forced to argue along two lines: first, against the sharing of existing commercial content, and second, against the development and sharing of alternative content. If the first case was difficult to make, the second has been proving almost impossible.

This has had a significant impact on education. A growing tide of opinion has begun to support the Open Access movement, driven largely by the argument that scientific research and educational content produced through government investments ought to be freely available.

In some cases, the freeing of such information have been voluntary, as in the case of agencies such as MIT, which created OpenCourseWare, and the Open University, which produced OpenLearn. (MIT OpenCourseWare, 2004) In other cases, such as at NIH, a government mandate has provided the impetus. (Suber, 2008) Meanwhile, a great deal of grass-roots work has been undertaken, such as resulted in the development of open access journals such as PubMed and open access software, such as OAI and DSpace. (Enrique Canessa and Marco Zennaro, 2008)

The public, too, has enthusiastically developed itself to the free content movement. Following the example of the groundbreaking Wikipedia, volunteers have been instrumental in creating resources such as Curriki, WikiEducator, and Wikiversity. Additionally, employing Creative Commons licenses, which grant people the right to reuse their work, web users have uploaded millions of photos, videos, web pages, and other digital contents.

Even if commercial publishers win strong copy protections from policy makers and technology companies, the trend toward free and open content will overwhelm them. As it stands, content producers are beginning to understand that it is better to allow their content to circulate freely, without restriction. This is because such content offers unequaled marketing and promotional opportunities, especially for new and not well recognized acts. (Rainsford, 2003) Additionally, content syndication agencies, such as YouTube, are finding ways to recognize commercial content and allocate advertising revenue to the owners.

The Learning Marketplace

The proliferation of both learning materials and learning providers has created a renewed focus on ownership. Issues surrounding copyright, trademarks and patents have been central to the field of online learning over the last ten years. Simple questions about the ownership of course material have evolved into complex questions about the ownership not only of course content but of software systems, business process, and even the idea of online learning itself.

What used to be a market dominated by large institutions and large publishers is beginning to fragment. While large commercial players will remain in the field of education, volunteer contributions and small enterprise will play an increasing role.

Through content distribution networks that recognize and retain authorship information over pieces of content, those who create work may be compensated – or not, depending on their desires – as the work is used in or outside commercial contexts.

What should be understood, however, is that the bulk of educational content online will be free to access and reuse. It will be created by governments, foundations, companies and individuals, and will be permitted to freely circulate, used by students and instructors worldwide to support their own learning.

As with the market in open source software (and perhaps even more so) the commercial presence will be seen most of all through the provision of *services*. There are two major criteria for any educational good to obtain financial return in the marketplace: first, it cannot be something that can be digitally duplicated, for then the effective value per unit approaches zero; and second, it cannot be something that the users of that good or service could easily produce for themselves, for once again, the effective value per unit approaches zero.

Today, much of the value derived from the learning marketplace is based on an artificially imposed scarcity – a scarcity of seats in classrooms, a scarcity of credentialing agencies, and a scarcity of educational publications, for example. These scarcities will disappear as governments prefer to fund education directly, and at cost, rather than support such business models.

That is not to say that no money may be made on content, or collaboration, or any other educational product or service. Just as the odd YouTube video is able to sell thousands of dollars worth of advertising, some educational content will also find a commercial niche – Randy Pausch's Last lecture is a good case in point. (staff, 2008)

But in general, educational enterprises will have to be more creative in finding opportunities. Content providers will discover there are much larger markets to be had when they help people create their own content. This will be the basis for the educational marketplace of the future. In general, helping people provide for themselves – helping them, in other words, save time and money – will provide the best opportunities. Selling people cameras instead of pictures, for example. Course content creation kits instead of courses.

Instructional Technology

The Platform

As mentioned above (in the section on personal learning environments) the major shift in instructional technology will be from systems centered on the educational institution to systems centered on the individual learner.

As a result, rather than the employment of a single system to accomplish all educational tasks, both instructors and learners will use a variety of different tools in combination with each other. These tools, as described above, will communicate with each other, and will support the acquisition and creation of learning content, as well as activities such as games or real-time collaboration.

As described in the section on virtualization, these tools will operate in a portable environment. Operating systems, rather than being tied to a particular type of machine, will become more like portable data files that can be plugged into one type or hardware environment or another as needed.

As this sort of model gains currency, designers will pay more attention to the concept of *the platform*. We have seen this already in discussions of 'facebook as platform' or of 'second life as platform'. In general, a platform is a software environment in which third party applications may be loaded and run. We are on the verge of experiencing a proliferation of platforms – software platforms like facebook, mobile platforms like the iPhone, appliance platforms like your fridge or stove, and more.

In a sense, the platform of the future will do exactly the job assigned to the instructional management system of the past: "an instructional management system is the backbone motherboard into which all educational components are plugged." This analogy remains apt today. However, with a proliferation of platforms, a central question emerges: who manages the platform?

It used to be the case that, if the platform was a web server – such as a university LMS – then it was managed by the organization that owned the server. And if it was a local system – such as a personal computer – is was managed by the owner of the computer. As platforms depend more on external services, however, the question of management becomes more vague.

Just recently, for example, it was revealed that Apple has an 'off switch' it can use to disable any application on a user's iPhone. (Slattery & Moren, 2008) In this it joins the tradition of the telephony industry, which has always retained control over the hardware, control over the handset. In the computer and software industry, such control is found under the heading of 'trusted computing' – parts of your computer that are managed by software companies, and not computer owners. (Stallman, 2007) Once might cynically say that the trend is toward licensing hardware in the same way as we have started licensing software.

All cynicism aside, it remains that, in order to be successful, platforms will have to help people do the sorts of things they want to do. Issues of control will become secondary if people are not prevented from, say, communicating with each other or obtaining information. On the other hand, if the platform becomes an advertising vehicle or an instrument of censorship, it will be eschewed – eventually – in favour of more useful technologies.

Tracking

Tracking and reporting are the major functions required of a learning management system today (and main reasons institutions want to keep using them). No matter what device a student is using, no matter where they access an online course, the LMS can report on what they have viewed (and reviewed), keep track of test scores and upload grades, and provide a secure, monitored location for in-class conversation and collaboration. (Moran, 2002)

Future learning technology will need to support such functions, at least to some degree. The recognition of learning, whether by institutional certification, third-part testing, or community reputation, is to a significant degree a matter of reporting activities and achievement.

Understanding this function of future learning technology is critical to understanding its construction. Consider a bookmarking service such as del.icio.us, for example. Although its primary function is to allow a person to manage his or her bookmarks, it also becomes a record of what that person has read (or, at least, seen). Consequently, the bookmark as public performance and record becomes one of its primary functions.

Understanding such technology in this light highlights the issues that will have to be addressed. Such systems will need to be accurate and reliable; they shouldn't report things that haven't happened. At the same time, they need to be, to a certain extent, voluntary. People want to control the work they are offering for assessment, even it if is work as trivial as a browsing history. That is why the same people who turn off tracking systems and refuse to load images will at the same time happily fill pages of del.icio.us recommendations.

Tracking systems in the future will be more automatic – filling out forms loses its appeal after a while – but will remain in control of the user. One element of this will involve the user's ability to assume different identities for different tasks. People will not find it fair or reasonable that their Second Life socializing be a part of their Ancient History class evaluation or part of the job interview process.

As mentioned above, this process will create a trail of usage metadata – also called attention metadata – behind both the use and the resource. This metadata will be available for harvesting, and will be employed by aggregators in order to create a profile of the resource. Profiles will be created of different types of usage metadata, and different people will see different profiles of the same resource (or the same person) depending on what they think is important.

Conferencing

The topic of conferencing and communication has come up several times in this discussion. That should be no surprise; it forms the core of any educational system, and

particularly one in which learning consists of participating in a community, creating and sharing learning content.

In the field of educational technology, conferencing systems are typically divided between synchronous and asynchronous, the former describing technologies where communication occurs in real time, and the latter where communication occurs at discrete intervals. But as conferencing technology improves, these terms will tend to be used to describe behaviours rather than types of technology.

Consider, for example, a traditionally asynchronous technology such as email. It has now increased in speed to the point where people can have real-time conversations in email. Such technology comes to resemble a common synchronous tool, instant messaging. But instant messaging can be used to have an asynchronous conversation, where messages are left for people to pick up later. The two systems eventually merge into a single, text-based communications technology that may be used either synchronously or asynchronously.

The same is true of other modalities, though we haven't seen this so much yet because of the need for better bandwidth and storage. But a live video conversation may just as easily be thought of as a set of discrete video messages, where each person responds to the other in real time or delayed time. A broadcasting system such as UStream shows viewers the same content, whether they are viewing it live or after the fact.

Conferencing will increase in both size and flexibility over time. The difference in size will be the most obvious. Instead of postage-stamp sized videos, we will use wall-sized screens to depict each other at full size, with near-zero compression and latency (I have actually seen such systems; they require only the widespread deployment of very high capacity bandwidth).

Such systems will not be used like televisions or telephones. They will be used more like windows, always on, always connected, where you can see other people and chat with them on a casual basis. Other windows will be used to display the local news or weather or a live feed from a favorite vacation spot (managing the sound levels between windows will require some interesting management technology).

But they will be more than windows, as we will be able to use them as digital portals, sending any of our data or applications over to the other side, or to use them as two-sided computer screens on which to work on the same document at the same time. And they will be placed not only on walls, but on desktops, in books, and even through tiny private screens beamed directly to a person's retina.

People will learn to work with their conferencing system constantly turned on and with other people – as many or as few as they choose – just a glance or a nod away. Say someone's name – "Stephen?" – and it appears as though you are knocking at their window, or poking your head through their door. That is not to say that privacy does not

exist – people expect and want privacy – but rather that their environments will be more or less digitally porous depending on time and circumstances.

Content Filtering

Content filtering has become, for better or worse, a major part of educational technology today, and it has become, as I suggested ten years ago, clumsy and overbearing. Educators continue to complain about entire domains, such as YouTube – or entire technologies, such as Skype – simply being blocked by an institutional administrator.

This has been necessary because filtering technologies were, and are, largely ineffective. Email users continue to be set upon by spam, with the distribution of viruses and phishing attacks compounding the distasteful advertising messages. Objectionable content proliferates on the web as well, either in the form of direct advertising (such as pop-ups) or misleading content (such as spam blogs, or splogs).

As a matter of practicality, as I suggested ten years ago, students in schools are not granted access to the entire internet, but rather, reasonably safe subset of it. Government legislation and school policy has mandated the blocking of sites that contain disturbing or controversial content. It is unlikely that such a system will change in the short term, largely because it has proven impossible to block such unwanted content on a case by case basis.

The employment of content filtering in education sparks debate because the application of such technology is not limited to unwanted content. (Lipschutz, 2004) The wider internet has seen cases where an internet service provider has blocked the website of its union, and where telephone companies and cable companies 'throttle' content that competes with its core business. Ten years ago I suggested that filtering would be used to protect markets for vendors of educational content. Today such practices seem more possible, and are opposed by a widespread 'net neutrality' movement.

Probably, the only way forward will be to enable people to select what they want, rather than to force them to block what they don't want. It is not possible to imagine the sort of thing that will creep into your in-box (believe me) but it is possible to create a content aggregation network composed of trusted suppliers, friends, and friends of friends. The popularity of social networks in recent years is only partially due to the desire to connect with others; it is also driven by a desire to shut out unwanted people and content. It is no coincidence that sites such as Facebook began as exclusive enclaves.

People wanting safe community standards will use the community as a filter. Alternative content will flow around such enclaves; there are many communities on the internet. As people become increasingly frustrated with unwanted content, the internet will resemble less a broadcast medium and more a person-to-person communications medium. Business models based on content distribution and especially advertising will have to take note.

As communications networks come to be defined by sets of connections with contacts, rather than a smallish selection of channels, metadata and filtering will be more effectively deployed to personalize input. People will want to have as broad a network as possible, both to extend their own influence, and to stay informed. Adaptive filters will all people to monitor a wide community – all connected physicists, say – while focusing on a particular set of topics of interest. Other flags set by trustworthy people will propel content through these filters, creating, in effect, a notification network.

Content providers, such as governments, educators and news agencies, will be able to act as inputs into the communications networks. But they will have to reach people through intermediaries, who filter, fact-check, and interpret these communications. Many people will get their news from their friends rather than from CNN. (Outing, 2008) To have a voice, content providers cannot block file sharing. They will have to encourage it, because they are competing against many voices.

The Economics of Online Learning

The two schools of thought identified in my earlier paper can still be seen today. On the one hand, there is a body of opinion that states that online learning is more expensive than traditional learning, that the average online course costs thousands of dollars to produce, and that specialized systems, such as simulations, even more so. And there is the other voice that points to the economics of reuse and suggests that online learning, in the long run, will save money.

Both perspectives contain an element of the truth. Where online learning involves the development of courses, simulations, and other advanced software, development costs are very high. Such investments can only be justified by significant need. Flight simulators, for example, are expensive, but are cheaper than jet aircraft. Military and police tactical simulations recreate conditions that cannot otherwise be experienced, except in live and potentially dangerous situations.

On the other hand, if the work done to develop an online course serves merely to duplicate an in-person course already available to students, the expense seems questionable. Replicating classroom conditions is not the cheapest way to conduct learning online, and we become more experienced with the internet, alternatives emerge. A model of learning that puts much of the organization into the hand of students – such as is the case with the Massive Open Online Course being taught by George Siemens and myself – may prove to be much more cost-efficient.

Automation

All other things being equal, automation offers the potential to produce considerable savings, in cases where automation is possible and desirable. We have already seen teachers save a lot of time using online grade entry systems, for example. Tasks that

would have been a long involved chore – such as creating a slide presentation – are now easily accomplished with tools such as PowerPoint.

Automation does not mean the end of teaching careers, though. What automation allows is (as I said ten years ago) a 'deep personalization' of learning. Automation allows us to more easily create and present content, to more easily form groups and collaborate, to more easily give tests and take surveys. This frees instructors to perform tasks that have been traditionally more difficult and time consuming – to relate to students on a personal basis, to offer coaching and moral support, to learn about and analyze a student's inclinations and understandings.

These are specialist tasks, and as suggested ten years ago, it is likely that different educational professionals will fulfill different roles. Some will become testing and evaluation specialists, others will become coaches and advocates, still others will become content creators and presenters. As these disciplines evolve, tools will become more specialized, and practice will become more professional.

Savings

The first significant economic impact of online learning will be in the savings it offers over the traditional model.

In the wake of 9-11, and again with the more recent increase in the cost of fuel, many have begun to employ online learning – and other forms of computer conferencing – in order to save on transportation costs. As time goes by, parents and policy makers will begin to question the wisdom of employing fleets of buses and cars to move students to places where they sit and work on computers.

And although governments continue to build legacies in the form of brick-and-mortar schools, construction costs will decline over time, and the buildings that are constructed will, like the Living Arts Centre in Mississauga, serve the entire community.

Finally, as more and more educational resources are digitized, the enormous sums of money spent on things like text books and even wall maps will be reduced to a trickle. The need to maintain physical libraries will be obviated through the distribution of entire libraries of digital content on keychains or necklaces.

This is the advantage projects such as One Laptop per Child are attempting to realize. Despite critics who say that money in developing countries is better spent on books and teachers, placing such devoices into the hands of children is a worldwide diffusion of knowledge for a cost so low the savings are scarcely imaginable.

Finally, savings in staff costs per student will be realized when the traditional teacher-and-class model is abandoned. Much of the work of the traditional teacher – such as content presentation – will be done by computers, or by students for each other. As discussed above, the role of the teacher will be evolve into a set of specialized

professions. But while we are spending more money on each educational professional, the cost of education *per child* will be reduced dramatically, offering us – at last – a chance to offer an education to all our citizens, for a lifetime.

The largest savings will be realized by students (with the result that these will be the slowest to realize, since students to not have the economic or political means to hasten the onset of these efficiencies). The cost of learning texts will diminish to near zero. Transportation costs will be eliminated. Opportunity cost – such as the four years of work and experience foregone in order to attend school – will be limited. Students will be able to begin working and earning early in their educational career, resulting in a longer period of productivity, and more wealth, opportunities and choices later in life.

The Bottom Line

As I stated ten years ago, and as we see today, even though savings will not be as great as anticipated, it will be necessary for institutions to offer their courses online - and sooner, rather than later - because the costs of not doing so are too great.

Distance learning institutions, such as Athabasca University and the University of Phoenix, are beginning to cut into traditional student bodies. It is becoming necessary for traditional institutions to accommodate more students with existing resources, which means that the pressures to take advantage of the potential savings offered by technology, which were not so great before, are now mounting.

Even more to the point, all educational institutions are facing their greatest competition from their students themselves. This is especially the case in nations where college and university degrees can be obtained only by a moneyed elite. A determined population of ambitious, talented and self-sufficient students *can* educate themselves, creating their own community, their own professions, their own future. We are seeing this unfold before our eyes, if we would only look.

The Future

Today, and for the last century, education has been practiced in segregated buildings by carefully regimented and standardized classes of students led and instructed by teachers working essentially alone.

Over the last ten years, this model has been seen in many quarters to be obsolete. We have seen the emergence of a new model, where education is practiced in the community as a whole, by individuals studying personal curricula at their own pace, guided and assisted by community facilitators, online instructors and experts around the world.

Though today we stand at the cusp of this new vision, the future will see institutions and traditional forms of education receding gradually, reluctantly, to a tide of self-directing and self-motivated learners. This will be the last generation in which education is the

practice of authority, and the first where it becomes, at has always been intended by educators, an act of liberty.

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The Future of Online Learning

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Introduction

Online learning is in its infancy. As pioneers struggle with new technologies and new practises, the discipline evolves almost daily. An online course that was considered state of the art twelve months ago is today considered to be out of date. Technology employed only by early adopters last fall is this summer in wide circulation and in danger of becoming obsolete by the fall semester.

Yet despite the rapid change, trends may be identified, trends which point to the future of online learning. What will be is not as radically different from current models as may be conceived, however, some significant shifts in the nature of online learning, and learning in general, may be identified.

This Essay does not attempt to describe what ought to be, but rather, what will happen. Although I am a deep supporter of online learning for many reasons, I have chosen instead to focus on prediction rather than prescription.

The reason for this is that, if we are aware of where the field will take us, we are more able to shape the manner in which we will travel and the environment in which we will reside. Knowing the future helps us to a significant degree become shapers of the future.

Future Technology

Technology, they say, should not drive content. However, when technology is the bottleneck through which instruction must be delivered, then technology, if it does not drive content, most certainly limits content. Today, institutions offering online learning must live with the reality that instructional material must be delivered through narrow pipes to underpowered computers running dubious software. In the future, this will all change.

Bandwidth will in the future be essentially unlimited. By bandwidth, we mean the amount of information which may be delivered from a server site, such as an educational institution, to a receiver site, such as a student's computer. Today the standard falls at around 28,800 bits per second, or in other words, roughly a page of text, a medium sized image, or a few video frames. Bandwidth limitations preclude the use, in many settings, of innovative Java applets, multimedia, video and videoconferencing.

This will change, and it will change sooner rather than later. In many Canadian and American cities, high speed access is offered by cable television services. Telcos are responding with better data compression technologies, such as ADSL. In the last year,

networks of LEO (Low Earth Orbit) satellites have been launched. Towers supporting digital wireless internet are springing up. It is not unreasonable to state that, in the face of these innovations, that bandwidth will be ubiquitous and cheap.

Computers will become more reliable and will look less like computers. This development will be driven on two fronts. First, processor and memory speeds and capacity will continue to increase. The present doubling of capacity every eighteen months or so shows no sign of abating. Your Pentium 75 computer, which was state of the art just two years ago, is now a candidate for replacement. The next significant change in computer technology will occur in a year or two with the introduction of 64 bit processors - gaming systems, such as Sega or Nintendo, already employ these high capacity chips.

And second, computers will become more reliable because they will become more specialized. Today's desktop computer, which does everything from word processing to internet access to graphic design, will gradually fade out of existence, as more specialized machines designed for particular applications will come to the fore. Computers will become appliances - some already have, such as your digital alarm clock, microwave timer, and programmable VCR. In the future we will see specific machine for specific tasks. Already we see Apple computers employed increasingly in niche markets, such as graphics and video design.

This trend will accelerate in the future. The phenomenon of *embedding* - that is, placing computer support in traditional appliances, is already well documented. Additionally, new appliances for new tasks, such as word processing, web surfing, or game playing, will rise to the fore. We see this already with the development of such tools as Web-TV and Sega Gamestations. This trend will accelerate because the resultant systems will be faster, more reliable, and cheaper.

Operating Systems, such as Windows 95 or Unix, will fade to the background, out of sight for most users. The current trend sees operating systems doing more and more for the user. Windows 98, for example, introduced an internet browser to the suite of operating system features. This trend will reverse, not because the United States Department of Justice disapproves, and not because computers cannot handle such large and complex programs. The trend will reverse because such systems are *inflexible*.

Current operating systems exist because today's computer programs are *task based*. For example, one program acts as a word processor, another acts as a spreadsheet calculator, and so on. The operating system is required to help users launch these programs and to help these programs work with each other. First you start the operating system. Then you use the operating system to start the program.

Computer programs of the future will be *function based*. They will address specific needs, launching and manipulating task based applications on an as needed basis. For example, the student of the future will not start up an operating system, internet browser,

word processor and email program in order to start work on a course. The student will start up *the course*, which in turn will start up these applications on its own.

The operating system will not be needed to control these applications because the course software will do that. Except for a slim menu which allows you to start your course, the operating system will fade into the background, broken into component parts. These components would be run only when needed by an course or an application started by the course.

There are two reasons why operating systems will evolve in this way. The first is the demand by users for *simplicity*. It will be seen as absurd that a user needs to learn how to use Windows before being able to send a postcard to Grandma. And second, operative systems and task based programs will need to fade to the background because they are *constantly changing*. It is absurd to expect a user to relearn the operating system and applications every six months or so.

New Technology in Education

To identify trends in education, perhaps the best methodology is to identify trends which work well today, whether technologically-based or not. In other words, identify the tools people actually *use* today, and examine how computers of the future will evolve these tools for use in the future.

And the tools most widely used in education today are remarkably simple, having remained unchanged for the last several centuries. They include books, notepads or paper, writing implements, blackboards, and teachers. Of these, obviously, the role of the teacher is the most complex and will have to be discussed in detail. The remaining tools, however, will be absorbed by the new technology in a very straightforward fashion: the PAD.

The PAD (Personal Access Device) will become the dominant tool for online education, combining the function of book, notebook, and pen. Think of the PAD as a lightweight notebook computer with touchscreen functions and high speed wireless internet access. The PAD will look like a contemporary clipboard and will weigh about as much. Its high-resolution screen will deliver easy-to-read text, video and multimedia. The PAD will accept voice commands, recognize your handwriting, or accept input via a touch-screen keyboard.

Various PADs will evolve, depending on need and application. Small three-by-five folding PADS will fit easily into a jacket pocket and will be taken on business trips or vacations. More standard eight-by-eleven PADs will be the workhorse of educational institutions, businesses, and the home. Large-screen WADs (Wall PADs) will hang from walls for home entertainment, business presentations, or education.

The use of PADs in education will have two major consequences. Education will become truly personal, and it will become truly portable. Personal, because the PAD will serve as

an individual student's primary educational tool. And portable, because PADs are portable. PADs are about five years away. Their development, and emergence into common currency, will occur in a fashion similar to the emergence of the cellular telephone today. They will cost about three hundred dollars.

Presentation software will become full-featured and easy to use - but not design. The glory days of do-it-yourself HTML, if they ever existed, will wane as greater bandwidth and capacity greatly enhance the designer's ability to present learning materials. Just as today few instructors produce their own instructional CD-ROMs, so also in the future instructors are unlikely to produce their own instructional websites.

This is not to say that the instructor of the future will not produce his or her classroom materials, just as the emergence of video recording or CD-ROMs does not preclude an instructor from photocopying a class handout. But like class handouts, the content of such material will refer students to more full-featured instructional materials, just as today class handouts refer students to texts, videos or CD-ROMs.

Educational software of the future will include every feature present in video games today, and more. For a good example of the sort of learning environment which will become widespread in the future, look at products such as Sim City or Sim Earth, from Maxis. The point of educational software will not be so much to present a stream of information to a student as it will be to place the student in an environment where the information needed for success in that environment will be actively sought and learned.

All the essential tools for multimedia educational software either exist now or are in early stages of development. Products such as Powerpoint and Director have evolved into richly textured multimedia containers, moving from page to page either *via* preprogrammed settings or user input, presenting graphics, video and sound, responding to student choices, and connecting to other resources.

Virtual reality and simulations already exists to a great degree of sophistication for military and aeronautics applications, and this technology will move to the personal computer interface level with the development of more powerful PADs and intuitive manipulation devices, such as the data glove. Even more sophisticated total immersion simulators will be available at community learning centres and will be for a variety of skills based learning activities.

But not just that. To give a student an idea of what the battle of Waterloo was like, for example, it is best to place the student actually *in* the battle, hearing Napoleon's orders as they become increasingly desperate, feeling the recoil of one's own musket, or slogging through the mud looking for a gap in the British cannons. Virtual reality already exists to a high degree in such games as Doom and Quake, Microsoft Flight Simulator, and a variety of other games. It is only a matter of time before similar products are designed with educational objectives in mind.

Educational software will differ from contemporary gaming software only slightly, and at that, mainly behind the scenes.

Interaction and Online Conferencing

Online conferencing will be a major tool used in education and almost all other areas of endeavour. As such, conferencing will be used in education for both discussion of the subject area, and also to teach students how to use online conferencing. For the effective use of online conferencing will be a skill as important in the future as are the social skills taught in schools today.

Probably the most significant decision made by distance educators today is in the choice of conferencing tools to use in support of distance courses. Institutions are spending tens of thousands of dollars on teleconferencing bridges, interactive television, and internet conferencing suites. These investments are for the most part misplaced. In the future, online conferencing will be easy and cheap. The expensive purchases of the past will be scavenged for parts, if they are hardware, or discarded, if they are software.

Synchronous conferencing is conferencing which takes place in real time. For example, a telephone call, classroom lecture, or conversation is a synchronous conference.

Today, interactive television (ITV) is the synchronous communications medium of choice for many distance education institutions. It will be obsolete within five years. Internet video conferencing will take its place, not only because it will be cheaper, but because a system which can transfer data as well as video will be preferred to a system which can transfer only video.

Synchronous conferencing systems of the future will consist of a basic platform from which users can opt to conference using a variety of tools: video, audio, text based chat, and whiteboard. Additionally, such systems will support file transfer, remote launching and control of applications, and more. These systems already exist; what is lacking is only the bandwidth to use them effectively.

Asynchronous conferencing is conferencing which does not take place in real time. A letter, a notice posted on a bulletin board, or a message on an answering machine, are all examples of asynchronous conferencing.

Today, most asynchronous conferencing is text based. In the future, asynchronous conferencing will evolve from being text media to full multimedia. Already, video email clients are available, and most online technology newsletters are published in full HTML format. Students, equipped with multimedia messaging clients, will be able to embed sound, images and videos into their messages.

Conferencing standards and protocols. Today's commercial online conferencing tools are (a) expensive, and (b) proprietary. Online educators who select Lotus Notes, First Class or Web Crossing are committing themselves to that product for the foreseeable

future. This is because educators must commit themselves to purchasing entire *systems* which cannot be used in conjunction with other conferencing systems.

Conferencing and multimedia standards are being developed today. Examples of this include SMIL (Standardized Multimedia Integration Language, pronounced 'smile') and the H.323 voice-over-IP standard for video conferencing. These standards will allow developers to introduce *components* of online conferencing systems, such as clients, which can work with any conferencing server.

Good examples of this already exist. Terminal emulation (or *telnet*) was developed in order to enable remote access to mainframe computers. Telnet standards, such as VT100, were developed. This enabled the development of a wide range of telnet clients which now allow any user on any system to access any remote mainframe.

Another good example is the world wide web. The web is based on a set of communications standards, called HTTP (Hyper Text Transfer Protocol). This allowed the development of independent clients, called *browsers*, to access any web server from any other system. Indeed, it is the very existence of HTTP standards that allows us to turn televisions, airport kiosks, or any other device we can name, into a web browser.

The same will happen with online communications. When a student wishes to post a message to a discussion board, for example, a standardized multimedia messaging client will launch and connect with the discussion board. The student will create the message, then sign off. When other students wish to view the message, they will use a standardized viewing tool (formerly called a *browser*).

Personalized Education

Imagine the best desktop computer you can imagine, slung over your shoulder like a slim handbag, connected to the billions of resources available on the internet, supporting instant multimedia communications anywhere on the planet, and you have a picture of the tool available for education within the next decade. The development of such a tool makes it not just possible, but inevitable, that education of the future will become deeply personalized.

Education today, from the kindergarten level to PhD seminars, is based on the model of the *class*. At the early levels especially, classes are organized not by the learning needed by the student so much as that student's age. In post-secondary education, age becomes less of a factor but education is still fundamentally time-based and depends on standard curricula for groups of students. The model is that of a group of people starting at the same time, studying the same materials at the same pace, and ending at the same time.

This model of education was adopted because it was the most efficient. It is heavily dependent on the teacher, and the teacher in turn is responsible for assembling, and often presenting, the materials to be learned. For the most part, customization and personalization are not practical, because personalized teacher-led instruction is not

practical. It is much more efficient to deliver the same content once to a group of students than it is to deliver the same content thirty times to individual students. Given the technology that we had, the class was the only practical solution.

Education in the future will be much less class-based, and much more topic-based. This already is the model being explored by such alternative educational models as programmed learning and constructive learning. The idea is that learning is not paced so much by the teacher as it is by the student's own capacity to acquire the material. Additionally, the topic selection for an individual's education will be based on that student's need, not the preselected curriculum for a particular class. Any given student may at any time be taking any given topic, and progressing at a pace through that material appropriate to his or her learning ability.

What will make this possible is the development of Educational Delivery (ED) technology. The primary purpose of ED will not be so much to *teach* as it will be to *manage learning*. Individual students will be served by ED along a variety of dimensions:

Topics will be selected student interest, student aptitude and educational level, and societal need. The menu of available topics presented to any given student will be determined by the student's demonstrated prior learning, by parent input and control, and by legislation governing education in that student's political jurisdiction. Selecting an educational topic, for a student, will be like selecting a channel on television. A student's daily menu will be varied and constantly changing, building on each day's achievement.

This model for the selection of educational activities - I call it the *Quest Model* - has worked well in gaming environments. As various people log on to an online game, they may be at different levels, have different inclinations, and have different abilities. The game presents a variety of quests for them to fulfill, based on their level, and they select from these quests based on their inclinations. As they select a quest, they are joined by fellow-travelers attempting the same quest (for often, a group is required for the successful completion of a quest). Some quests may be short - just a few minutes - while others may require a sustained commitment over several days.

Although unusual in institutional settings, except at the very coarse course-selection level, the menuization of educational topics is common in business settings. My first experience with this occurred in 1981 with Texas Instruments. In addition to two required courses, I had a wide range of options to choose from as supplementary learning (I selected *MVS-JES3, a processing language*, and *On The Way Up*, a communications course). Learning was self-paced, supported by manuals and videotapes (state of the art).

Today's internet is offering adults especially more opportunities for topic selection than ever before. There is a proliferation of online courses - some short and to the point, such as those offered by Ziff-Davis, others long and involved, such as those offered by Athabasca University. Potential students now typically access course indices, such as offered by Tele-Education new Brunswick, and select the learning which suits their needs.

But these are merely *course* selections. The prominence of the course is based on the class-based learning model. As *classes*, in and of themselves, fade from the scene, the selection of learning will drop to a lower scale, with topics selected in hourly or daily increments. This trend I describe as the *modularization* of learning, and is discussed below.

The Presentation of Material will occur automatically, powered by the ED system, based on the students' progression through the topic. While the presentation of material will in some cases be linear (as it is *always* in a classroom), such as *via* video presentations or text-based reading, in other cases choices will have to be made, while in other cases the presentation of material will be *multi-threaded* (that is, material on two distinct subjects will be presented simultaneously, as for example is common in music videos or on internet chatlines).

As students progress through a topic, material will be presented to them dynamically, according to one of the following mechanisms: (a) *student-selected*, from a library of background information on the topic in question (for example, the student reads a description of the quest from a scroll); (b) *event-driven*, by the system, when the student reaches a particular point in the course (for example, upon reaching Athia, the student encounters a shopkeeper with a tale to tell); (c) *time-driven*, by the system, after a certain time has elapsed (for example, after an hour, it rains, and the writing on the sheepskin is revealed); or (d) *instructor-driven*, by the instructor, as additional information is requested or volunteered.

The personalization of education just described will be adopted - gradually, as traditionalists fade out of the scene - not because it provides better educational results (this has yet to be proven, although it is likely) or because students prefer it (this again needs to be proven, but is again likely), but because it is more efficient. Classroom education is in many ways wasteful. Material is reviewed for thirty students when in fact only five need review. New material presented is absorbed by half the students, but is beyond the capacity of the other half. That time in class which is spent by a student *unproductively* - either waiting for an instructor to address another student's question, discipline problem, or other need - is eliminated through personalized instruction.

Or to put the point another way: so long as the *class* remains the dominant paradigm of education, the potential for improved efficiencies inherent in the new technology will remain unrealized. Only when the capacity for new technology to customize and personalize education are employed will the efficiencies begin to show.

Learning Styles employed by online learning systems will be tailored to individual students as well. Different students learn in different ways. Online learning systems will identify individual students' preferred learning styles, and present educational materials accordingly.

Thus, for example, students who learn best by *exploring* (for example, learning software by trying every command to see what happens) will be presented a variety of options they may pursue, while students who prefer ordered, linear presentations may be presented with a video stream covering the same material. Students who learn orally may watch and listen to a taped lecture, while students who learn visually may be presented with graphical representations of the concepts being covered.

Learning styles exist across a number of dimensions, and designers of educational systems will need to, first, prepare materials appropriate to each of these dimensions, and second, incorporate a method of selecting materials from different dimensions. Learning style selection may be enabled via (a) a *testing mechanism*, which sets a system's default values, (b) *student selected*, via a set of sliding scales for each dimension, or (c) *instructor selected*, to satisfy desired learning or learning style criteria.

Recording and tracking student progress, currently a time-consuming and dull job for instructors (often still accomplished in course gradebooks they way it was done in the fifties) will to a large degree be handled automatically by the system. While the instructor will still have an essential role in monitoring and evaluating student progress, the computer will compile the data required for reasonable and efficient monitoring and tracking.

Most people when they think of automatic monitoring and tracking, think of two things: first, auto-marked tests and exams, and second, progress logs. Each of these will have a role in the future, but a much smaller role than might otherwise be assumed, because of the wealth of data available to the online instructor.

For example, an online test might measure a student's (current) recall of physics, but often of more interest to the instructor is how that knowledge is *used*. Since all the student's interactions online can be logged and recorded, and since intelligent searches can locate instances of particular terms or concepts in a body of data, an instructor can identify when, if at all, a given concept was used during the course of studies.

Or, for example, the results from a student's work with a simulator (in crop planning, say), may be fed directly into the student's course database. For example, suppose a student, based on the available data, decides to grow wheat and oats, applying pesticide and fertilizer to the crop at appropriate times. At harvest, the simulator would calculate the resultant yield, and feed this result to the student's database, where, if appropriate, completion of the simulation would be graded and the mark applied to the student's overall result.

Such dull tasks as recording grades, monitoring attendance (or participation) and progress, and the like, will all be performed automatically, the results presented in intuitive and informative graphics or charts.

What will *not* happen is this: students will *not* be summatively evaluated by the online learning system. In the end, insofar as they are graded, they will want to be graded by a

human. The reason for this is much more psychological than it is practical. People will not react well to being graded by a machine. They will not like the automatic no-appeal-possible quality of such a system. Even where all inputs to the system automatic, students would want the final result consulted by, evaluated by, and awarded by, a human being.

Time and Place Independence

Online learning is in essence distance learning, and distance learning in turn is characterized by time and place independence. Today's online learning, while clearly time independent, is not so clearly place independent, as students are tied to a computer terminal and internet connection. The emergence of PADs will change all that.

Time independence is often characterized in terms of a student's working hours. When characterizing time independence, for example, writers often point to a student's ability to study in the evening, or to study weekends. In a rural environment, where one's time for study is dependent on the crops and the weather, time independence is often characterized in terms of being able to work on rainy days, or after the crop is in for the winter.

Time independence in online learning is all of this and more. The best way to characterize the change is to say that time in online learning *ceases to be* an objective standard which applies to many people at once, and instead *becomes* an individualized standard, against which personal learning and achievement are indexed. This is seen when we look at how time is employed as a (relatively constant) variable in traditional learning, and employ it as a (relatively flexible) variable in online learning.

In particular, the following time-variables may now be adapted to individual needs: daily start and end time, hours of work, break time, time per lesson, time per activity, time per test, days of the week, month or year worked, hours per week, month or year worked, start date of a course or other educational activity, end date for course or activity, number of courses in a week, month, or year. Etc. Each of these variables may be set *individually* for each student, where time, rather than being a static backdrop against which learning is conducted, becomes a dynamic resource allocated on an as-needed basis.

A word about pacing is needed at this point. One reason the traditional class model is favoured by so many educators is that self-paced learning is regularly effective only for highly motivated students. Where motivation is lacking, or where other factors, such as job or family responsibilities, intervene, self-paced learning is less effective. The low completion rate often associated with self-paced distance learning is evidence for this. Especially with younger or more at-risk students, pacing is necessary.

So it should be clear that time independence does *not* entail self-paced or non-paced learning in all circumstances. A variety of methods can and will be employed in online learning systems to ensure a regular and orderly progression of students through their coursework. What distinguishes online learning is that this mechanism for pacing may be applied at the *individual*, not the group, level. Moreover, pacing, in an online learning

environment, is determined by a wide variety of factors, and not the more narrow range of factors which influence pacing in traditional classrooms.

In online education, the parameters for pacing will be set based on input from the learning system, from the instructor, from parents (where applicable), from the student, and from the educational jurisdiction in thigh the learning takes place. Each of the parameters listed above will be set according to these inputs, so that each student has a clear (and individualized) set of temporal parameters associated with his or her learning. These parameters in turn form the basis for time-driven system events such as the presentation of materials, testing and evaluation, and deadlines.

Place independence does *not* mean studying at home, although it does not prevent this. Place independence means that students are not tied to any particular location as they conduct their learning activities. Traditional and even contemporary distance learning is not especially place independent. True place independence will revolutionize education is a much deeper sense than has perhaps been anticipated.

Traditional education is, of course, not place independent at all. This is the case because, first, students must be assembled into a class at some particular location, and second, because they must be located where the learning resources (the teacher, the library, etc.) are located. Thus in traditional education, students assemble at a certain place - a school, college or university - each morning and stay there until the day's learning activities are complete.

In distance learning, the materials are brought to the student. Thus the teacher is presented to the class either via audio or video conferencing, or mediated via print or electronic instructional materials. Yet even this form of learning is not especially place independent. Although it is true that print materials may be read anywhere, except perhaps in the shower, students otherwise must be located by a computer, telephone, teleconferencing facility or ITV classroom in order for instruction to occur. While *less* place dependent than the traditional classroom, students nonetheless do not have the full mobility that deep place independence implies.

Online education will in the future be place independent in a deep sense, because the student's primary learning tool, the PAD, will be highly portable. Just as today a student could teleconference from anywhere using a cellular telephone, students of the future will be able to learn anywhere with the PAD. One can picture students snuggling under the covers reading Descartes or watching Macbeth, lounging in the park working out geometry problems, or sitting in their living room practising their French.

Moreover, as educators realize that students are not bound by any particular location, instruction of the future will *encourage* mobility. Political science students, for example, will be *expected* to frequent City Hall or the provincial legislature. Forestry students will work *in* the forest. In the future, education will not be an activity conducted in the cloister of a separate building. It will be common to see groups of schoolchildren visiting shops to learn about budgeting and economics, visiting clinics to learn about first aid, visiting

retirement homes to learn about history. Education in the future will move from the school into the community.

For adults, education will be an activity engaged in on a regular and routine basis, much like reading or watching television today. People on the job will spend slow time brushing up their skills. Commuters will work on their classes on the buses and rails. Saturday mornings will begin with breakfast, the morning paper, and a quick history lesson. Many adults already do this today, except it's called *reading*. In the future, reading will become interactive, and a student's reading and interacting will count as an educational pursuit, and rewarded as such.

The School of the Future will not look like today's institutions, which dominated by classrooms, lecture theatres and libraries. All of these facilities will not be used even remotely to the degree they are today. Schools will be converted into meeting facilities, for face-to-face interaction, and laboratories, where workstations and specialized equipment are available for student use. The lecture theatre will not disappear completely; it will be used for special events and gatherings. Libraries will evolve, coming to resemble museums, housing one-of-a-kind documents and other rarities. But the concept of the school itself as a place where learning is conducted will become obsolete.

Schools will become much smaller, both in terms of size and of populations served, and will become highly specialized. Community schools, once on the wane, will re-emerge as community learning centres, serving a student base of about 200 students and a community of no more than 500 people. Cultural schools will abound; some schools will incorporate chapels and religious training, while others sweat lodges and powwows. This will occur because, as learning is individualized, the economies of scale which propelled the construction of massive regional schools, will no longer apply. Larger schools, to which students must travel a half hour or more, will be seen as inefficient.

Computers, in general, will bring community back into our lives. That sounds ironical and even implausible, but it is inevitable. For the least expensive thing to move is information; the most expensive thing to move is people.

Convergence. The evolution from traditional classroom based institutions to online learning based institutions will be gradual, and characterized by an increasing convergence of methodologies and technologies employed by both online and classroom instructors. While today it makes sense to categorize learning as either *on-campus* or *distance*, in the future this distinction will become harder and harder to draw.

We can see this phenomenon in classrooms today. Increasingly, instructors are depending on learning tools, such as CD-ROMs, videos, and other multimedia tools, to support and enhance learning. Additionally, thousands of instructors have started to place their class outlines, background materials, and other materials on class websites. The tools and techniques of online learning are being found increasingly in the classroom environment.

Critics complain that this amounts to no more than an offloading of printing costs from the institution to the student. This argument would hold more weight were students not typically charged for photocopying expenses. But in the long run, as the PAD becomes easier to use, students will rely less and less on printing and more on online reading. Moreover, material placed online also has the potential to become more interactive. One could print a self-test quiz, for example, but what would be the point? Students are much more likely to take the quiz online.

As with any convergence, there will be no point at which we can say definitively that classroom learning has effectively merged with online learning. Probably the institutional structures which marked the delineation will long outlast the practical distinction. Already traditional classes exist in which there is no formal lecture or meeting time, the interaction between instructor and student being handled entirely online and through meetings with individuals and small groups. We have passed the leading edge of this wave.

Learning Communities

Humans to a large degree are social animals, and consequently, the most important of our needs are served by communities. This is why, even when travel is difficult, we tend to cluster in cities, towns and villages. It is why, when you look at children playing in the schoolyard, they are not dispersed, but clustered. Why bars, clubs and recreational facilities attract us. And so too with learning. Education is not merely the acquisition of new information and skills, but a social activity, where knowledge and skills are demonstrated, criticized, or merged.

Education is a social activity, and that is why the picture of distance learning wherein each person studies from their own home, supported by a personal computer and desk videophone, is wrong. To be sure, there is room for home study, but people, and especially children, need community as well. It is because of this that online learning in the future will emphasise community much more than is perhaps imagined today.

Two major types of community will rise to prominence over the next decade or so: the topic or interest based community, and the physical or peer based community.

Interest based communities are collections of people who, although they may be geographically dispersed, share a common location on the internet. We see these emerging already. Gardeners hang out at gardenweb. Computer geeks hang out at Wired. Distance educators have found a home at the Node. Across the internet, thousands of topic-specific communities have begun to emerge.

The existence of online communities has drawn a lot of commentary over the last year or so. This is in part because of their proliferation, but also because the dynamics of an online topic based community are singular. From time to time we read about the close and intense relationships developed by members of online communities, about the

openness of communication in an online environment, about the degree to which people commit themselves to their online homes. All of this is well documented.

Online educators will find themselves building interest based communities whether they intend to do this or not, because the mechanics necessary for the creation of an online topic based community are present in the structure of almost any online course. In order to create a topic based community, one only needs a topic, a group of geographically dispersed people interested in that topic, and a means of shared communication, such as a bulletin board or online chat.

What will change in the future is that online educators will better learn how to foster and nourish online communities. They will want to do this because, the greater the dedication to the community, the greater the dedication to learning, since learning is the shared experience which defines this community.

The factors which contribute to a successful online community are to some degree known, though that said much more empirical data needs to be collected. But in general, one of the keys is *ownership*. By that, what I mean is that the members of the community play a key role in shaping the community. For a community is not a broadcast medium. It is not a place where the organizer provides material and the members consume it. It is a shared and constructed environment, where the members along with the organizers play roughly equal roles in content creation.

In an educational context, what this means is that a lot of the learning - and learning materials - will be those constructed by the students themselves. We begin to see this with the use of discussion lists in online courses, but also in the creation of topic-based web pages (and other resources). Students online also tend to be very vocal in their criticism of the interface, of the instructor's tone, of the usefulness of resource materials, and of the colour of the background. As much as possible, these comments should be incorporated into educational materials; in the future, students will define these themselves (and criticize each others').

We have already entered the era in which lifelong friendships are formed between people on opposite sides of the planet. Online learning will inevitably tap into this trend, and because of the deep nature of the learning experience, will accelerate it.

Peer based learning communities by contrast almost by definition cannot be formed over the internet. They will exist because online friendships lack fundamental qualities that humans are unwilling to go without. People need a pat on the back, a (physical) shoulder to lean on, a drinking buddy, an opponent for squash, somebody whose physical presence, for one reason or another, *matters*.

Peer based learning communities are in fact the polar opposite of online communities. While online communities depend on a topic or area of interest to exist, peer based communities are topic neutral; one person may be a scientist while another may be an

artist. While online communities consist of geographically dispersed members, peer based learning communities exist in some particular geographical location.

A peer based learning community will be that group of people attending a particular school or learning centre (as discussed above). People become members of the community because of a shared location, workplace, cultural background, religion, or language, and because of shared experiences in online learning. While people in a topic based community, for example, will discuss this or that monograph or expert in the topic, people in a peer based learning community will discuss this or that institution, interface software, or community events.

Peer based learning communities are vital to learning because they provide a safe environment in which to learn. A person does not feel cast adrift on the sea of the internet when working in a community of people facing similar needs and challenges. Though each may be pursing a different educational goal, their overall objective and means of travel is the same, and thus they offer mutual support, encouragement, and reassurance.

As with online communities, we are beginning to see peer based learning communities emerge in all manner of locations. From personal experience, I can cite the learning centre in Fort St. Jean, in northern British Columbia, shown to me by the people at Open Learning Agency, or the fishers' retraining centre, a block away from the urban aboriginal training centre, fostered by the New Westminster School Division. Or the South West Indian Training centres in Sioux Valley and Waywayseecappo, in rural Manitoba. Or even the group of people in Brandon and area studying instructional design from Athabasca, who one after the other all seemed to show up in my office.

The existence of, and need for, both interest based and peer based learning communities will have a significant impact on the design and delivery of online instruction in the future. Much of what follows is based on the assumptions stated in this section.

The Triad Model

The triad model identifies three key players in online learning: the student, the instructor, and the facilitator. The existence of a new player - the facilitator - is necessitated by the distance between instructor and student, and the need for a peer based community as well as an online topic based community. Many of the tasks assumed by instructors in traditional education devolve to the facilitator in online education.

The Instructor in online learning may be located anywhere. In most instances, the instructor will be located at some distance from the student. Working with the ED system and communicating directly with the student online, the instructor plays three major roles: (a) as a facilitator of learning, (b) as a content-area specialist, and (c) as an evaluator.

As a facilitator of learning, the instructor provides instruction and guidance on the use of learning materials. For the most part, this involves the sequencing of learning materials

and activities, monitoring pacing, and where appropriate, communicating directly with the student, the on site facilitator, or parents. The instructor also fosters student interaction and supports the development of the online community which will arise surrounding his or her instructional content.

The instructor's primary role is as a content-area specialist. It is expected that an instructor in a given field will have possess qualifications and credentials in that subject area. The instructor is not expected to provide lectures - this sort of instruction is provided in the course materials. But the instructor is expected to respond to student queries in an informed manner or to offer new or additional information in the subject area.

As an evaluator, the instructor tracks student progress and receives student assignments and exams. These assignments are either graded by the system or graded by the instructor, with the results in all cases returned to the student online and entered into the student's ED records.

The Facilitator is located in or near the student's home community, generally based in a community learning centre or school. While the instructor communicates with a student from a distance, the facilitator will generally communicate with a student in person.

The facilitator is responsible for the provision of technical support in the use of computers, internet, on-line course materials, multimedia materials, and other technology. He or she also acts as a mentor, provides study skills and time management training, if required, and supports and encourages the student, and acts as an advocate for students, helping them navigate through the admissions process, course registration, and other administrative functions.

The facilitator is not expected to be a content-area specialist. The facilitator does not teach course materials and does not grade or evaluate students in any way. Rather, just as the instructor is expected to foster the interest based community, the facilitator is expected to foster the peer based community. For this reason, facilitators will most likely be drawn from, and hired by, communities rather than institutions.

The Online Learning Host/Provider Framework describes the institutional support for the triad model.

In traditional education, the host and the provider are the same institution. That is to say, the same institution which produces the instruction is also the institution attended by the student. For example, if I say I am taking a course from the University of Calgary, what I mean is that the course instruction is being delivered by the University of Calgary, and also that the University of Calgary provides the facilities where I receive that course instruction.

In the future, host and provider institutions will increasingly be different institutions. One example of this is course *brokering*, wherein the course I am taking may have been

developed by, and even instructed by, a University of Calgary instructor, but is being delivered at Red Deer College. Thus, when I take the course, I use Red Deer's classrooms, computers, and facilities even though the course is a University of Calgary course.

Host institutions will be by necessity geographically - and community - based. They will be the small, specialized schools described above, staffed by facilitators, and housing meeting rooms, laboratories, virtual reality simulators, and other tools too specialized or too expensive to be purchased by individual students.

Provider institutions, by contrast, may be located anywhere. With no time or location constraints, it will become increasingly common for provider institutions to service a global audience. We are seeing this trend develop already. Even today, I see course announcements posted almost daily on distance learning list servers such as DEOS or WWWDEV. It is now possible to take a course on almost anything from almost anywhere in the world. And although such course offerings are not always attractive, because of bandwidth limitations and pedagogical factors, these limitations will disappear as the field matures and the technology evolves.

Potential students will shortly be faced with a dizzying array of educational opportunities. Indeed, one of the primary tasks for host institutions will be to select and menuize course offerings. Typically, a host institution will support only a small subset of available educational opportunities, selected primarily by political and economic considerations. For example, government funded host institutions in Manitoba, such as schools or employment centres, are more likely to support courses and programs offered by Manitoba schools, colleges and universities.

But there will be a general fuzzing of traditional boundaries, especially in jurisdictions where the host and provider institutions are not governed, or at least associated, under an umbrella organization. For example, if host institutions in Manitoba developed onsite support facilities independently of the colleges and universities in that province, then they are far more likely to offer a menu of courses and programs from national and international institutions, and not primarily Manitoba institutions.

Provider institutions will find it essential to develop and nurture networks of host institutions, if only to secure a long term market for their course offerings.

Accreditation

The mishmash of host institutions, provider institutions, and umbrella organizations is going to result in an increasing debate over standards and testing. It is going to get worse before it gets better. It probably won't get better.

One of the consequences of online learning is that anyone with a computer, a modem, and a little knowledge can set up shop in the Cayman Islands and call themselves a university. Examples of such institutions already abound and are well document as, for

example, in *Bear's Guide to Non-Traditional Learning*. It will become increasingly relevant, standards bodies aside, to ask whether a graduate degree from Walden University is equivalent to one from the University of Manitoba, particularly when the latter suffers from underfunding and crowded, impersonal classrooms.

There will be no easy resolution to the debate over standards because there will be no widely accepted standards bodies. Because education is in many ways a culturally bound phenomenon, residents of one culture are not going to accept the verdicts rendered by representatives of another culture. We see this even today in the area of alternative religion-based schools. Graduates and diplomas are recognized in the religious community, but not generally in the secular community.

Learning, and the assessment of learning, will diverge. This trend will distress instructors who feel that class participation is essential to the learning process (and therefore must be evaluated), however, employers and standards bodies will become increasingly reluctant to recognize learning which is quantifiable by an index known only by the instructor. Independent standards based testing will be required for an increasing number of job or educational placements.

There is no reason why testing, in addition to instruction, may not be conducted online, and it is likely that host institutions will interact with testing bodies in the same manner as they interact with provider institutions (often, these will be the same institution). The host institution will be an essential component of online testing, because it will not be possible in the short term (or even the medium to long term) to verify a student's identity for the purpose of testing.

Tests quantify in ways project based or constructive learning do not. In an environment where everyone gets a pass or fail, it is not possible to distinguish between gifted students and those who succeed through endurance. Where opportunities narrow, as they do in higher education or entrance into the workforce, some quantification is required. The easiest, and fairest, way of reaching this determination is through testing. So while a constructive learning environment may get you through History 40S, it won't graduate you from high school, much less place you in the university of your choice.

Prior learning assessment and self managed learning will flourish in this environment, propelling to an even greater degree small, independent learning agencies which prepare students for testing but which do not themselves provide accreditation. Traditional institutions which accept such learning run the danger of relegating themselves into the role of testing agencies only, particularly if their fees are not competitive or their education substandard.

Successful educational institutions in an online environment will be those that realize that the fees they charge are for providing an educational *service* rather than for the distribution of information. Information, in an online environment, is cheap - many argue it is, or should be, free. With the increased emphasis on testing, students will not be *required* to attend a college or university to obtain post secondary certification. And

unless colleges and universities offer something over and above mere information, they won't *want* to.

Education as a service, not a product, will be the dominant catchphrase of the early years of the next century. Already we are seeing this trend as institutions become more and more 'student focused'. But this mantra, now more a slogan than an operating principle at most institutions, will become essential for institutional survival. For without service, institutions will offer their students nothing over and above the *Online Interactive Encyclopedia Galactica*.

At present, few, if any, institutions are focusing on this aspect of online learning, so lessons must be drawn from traditional institutions which excel in student service, and online agencies which excel in user service.

The former tend to be small, specialized and personal institutions noted for a high degree of staff-student interactivity. Good examples to look at in Canada include Mount Allison and Queens University. These are institutions which focus not only on learning, but also, in the fostering of a learning community. They offer a nurturing and supportive environment in which student participation is actively encouraged. Their quality of instruction is excellent, not so much in the material presented (since, after all, calculus is the same everywhere), but rather, in the way it is tailored to individual student needs.

Few online agencies yet exhibit similar standards of service. Internet services have yet to move *en masse* from the dominant metaphors of catalogues or magazines to the emergent metaphor of the online community. Those online services which are successful - including *Yahoo*, *Infoseek*, and *Firefly* - offer a high degree of customization, comprehensive (and again, customizable) indexing, and many opportunities for interaction. These are again sites which provide a community for online users, but also which provide a wealth of partially digested and timely information.

Successful online educational institutions will probably combine these characteristics. They will likely be small, specialized, and personal. Even where institutions are large, success will depend on their ability to subdivide into small, community-sized units. Successful institutions will provide a supportive and nurturing community, and at the same time present educational materials and activities in a highly customized and student-centred manner.

Modularity

Modularity is the idea that an entity we consider to be a single unit is in fact composed of separate and independent parts. For example, computers are to a large degree modular. Various components can be plugged in, switched, swapped, or replaced with better parts.

In the same manner, online courses will be modular. A course - especially from the designer level - will no longer be seen as a single unit, but rather, as a collection of component parts, each of which may be replaced or upgraded as the need arises.

The predominant model for course design will resemble the architecture of contemporary computers. There will be a *backbone*, analogous to the computer's motherboard, which establishes the basic structure of the course. Into the backbone will be plugged in various *learning modules*, *communication tools*, and *student information systems*.

Customized courses will be the first major application of a modular approach to course design. In the first instance, customized courses will be designed to meet the needs of particular clients. For example, a college offering a selection of business and computer courses may assemble a customized package for a corporate training client.

Suppose a Business course consists of modules on Business Writing, Financial Accounting, and Customer Service. And support a computer course consists of modules on Word Processing, Email, and HTML Design. A new course could be constructed by selecting desired course modules, say, a Corporate Communications course consisting of modules on Business Writing, Customer Service, Word Processing and Email.

As custom course design hits its stride, the demand for *individual* courses will arise. Students may need supplementary material in areas where they are week, or additional material matching their interests or aptitudes. Abridged courses may be offered to people with strong backgrounds in the field. Variations on the same course may be used for students working in different disciplines.

Menuization, a concept today employed primarily in the area of *course selection*, will in the future be employed in the area of *course construction*. Students or other training clients, perhaps working with an educational consultant or designer, will assemble courses, and programs of courses, from a menu of course components.

Indeed, the concept of the *course* itself will gradually be seen as an arbitrary division. The primary unit of instruction will be the module, and programs will be seen as large collections of modules. Viewed in this way, it may be seen how a program could be highly individualized.

Modules themselves will be modular. A learning module will essentially consist of a collection of educational materials, mechanisms for communication and interaction, and an assignment or evaluation component. Module design will consist of two major tasks: the *selection* of module components, and the *ordering* of module components.

The idea here is that a module is best thought of as the assembly of a sequence of educational activities. For example, a student may be required to read some material, engage in a simulation, write a report, participate in a discussion and complete a quiz. Each of these activities in turn requires the support of some educational materials. The task of the module designer will be to select those materials, and then to present them in a sequence.

Distributed design. Because the internet will support high speed data transfer, there will be no requirement that instructional components reside on the same computer - or, for that matter, in the same country - as the course being offered. For example, suppose there exists a high quality multimedia dissection of a business letter at an educational web site in Singapore. The module designer will have the option of plugging that resource into the online course.

This is already happening. Educational resource sites are springing up across the internet. The best example of this is Canada's Schoolnet, which provides a comprehensive set of media resources. *Virtual Frog*, a pioneering internet effort, is used in biology classes worldwide. My own *Guide to the Logical Fallacies* is widely used in logic and rhetoric courses.

Not only content based sites are employed in online courses. Companies such as *Hotmail* offer free email addresses, which are used by students worldwide. Online communities such as *Geocities* provide free web space, most of which is used by students. Chat servers, bulletin boards, personal pagers: all of these are available from suppliers who willingly allow their use in online courses.

What has not yet happened - but which will, in the future - is that these resources will be added to online courses in a *formal* manner. By that, I mean they will satisfy *educational object protocols*.

Educational Object Protocols are the rules which govern how educational objects will interact with each other. The development of these protocols is already under way, led by the Educom/NLII IMS (Instructional Management System). Of interest for course and module developers are two major components.

First, all educational resources will be accompanied by *metadata*. Metadata is data about the data. For example, an article about Saturn would contain data about Saturn - it has rings, it is a gas giant, and so on. Metadata would be data about the article - it was written by Fred Jones, it is located at saturn.com, and so on.

Second, educational resources will be written in *XML* (eXtensible Markup Language). XML is similar to HTML, but while HTML concerns itself mostly with how a document is formatted and displayed, XML is used to indicate the *role* of document components. Thus, authors, for example, will use XML to identify questions, asides, definitions, or any of a variety of other structural definitions.

Metadata and XML will be enormously useful for intelligent search agents, and these agents will be used increasingly for a variety of purposes: assembling specialized data, compensating authors, monitoring student progress - in short, anything which requires a structured retrieval of data from a variety of online sources.

Of concern to educational software developers will be the standard set of *function* or *object protocols*. These will determine what information an educational object requires in

order to be invoked by a remote system, and what information that object will return to the remote system. Consider, for example, how a user logs into the educational system. A student login would be handled by a *login object*, which expects as input (from the student) a user name and password, and returns (to the system and to the student) a *user object*. The *user object*, in turn, based on student or system input, interacts with other system objects to produce on screen displays, update student records, send messages, and a variety of other educational tasks.

The way in which these objects communicate with each other will be standardized. This means that online learning systems of the future will be composed of separate, interchangeable objects, each dedicated to a specific task. And what will happen in practise is that various software vendors will market programs consisting essentially of sets of these objects. Thus, for example, Web Crossing will market an online conferencing system which interacts with the remainder of an online course in a predetermined and structured manner.

Ownership and Copyright

Issues of copyright and ownership already play a major role in discussions of online learning. Most such discussion centres around the question of who owns course content. In the future, this question will not make sense because a course will not be seen as an individual entity which can be owned, but rather, a collection of entities, *each* of which can be owned.

This is in fact not so different from the system in place today. In a traditional course offering, various resources - such as textbooks, videos or CD-ROMs - are employed. Copyright for each of these individual entities is owned, not by the course instructor, but rather, by the publisher or author of the entity in question. Where material is reproduced, this reproduction is performed under license, either explicitly, as in the case of *CanCopy*, or implicitly, under the provisions of *fair use*.

The gray area will be in the case of materials which in the past were produced by instructors solely for their own classes, which in the new system, may be used by many other classes. For example, if a professor produces a set of notes on fallacies for his logic class, and this set of notes is purchased by another institution, the question arises: who gets paid, the professor, or his home institution.

This will remain a bone of contention for a very short time. The production of educational materials, now a relatively simple project involving a mostly rudimentary understanding of technology, will evolve into a highly technical discipline. Just as instructors do not typically create their own movies or videos to show in class, because they are too complex to produce on an as needed basis, so also instructors will not typically create educational resources for their classes.

Specialized Resources will be offered by large and small companies, targeting particular educational niches. For example, one company may offer a resource centred around the

poem *The Road Not Taken*. This resource would include audio readings of the poem, video background information, multimedia analytical tools, discussion and criticism, and additional resources.

The task of the online instructor will be to review the material, link to it from the instructional module, and assign students particular tasks related to the resource. While many such modules will be offered for free to educational institutions, by government, charities or corporations, others will be offered on a fee-for-use basis. Because these resources are playing for a global audience, the fee-for-use will be very reasonable.

A blossoming of such sites has already occurred on the internet. What we will see in the future is an entrenching of a few authoritative sites in particular subject areas. Because these sites will be expensive to maintain and create, they will eventually seek funding, either from government, from advertising, from the sale of information (for example, user demographics to advertisers), or by direct charge.

Online services will be offered by subject matter experts independently of any given institution. For example, leading authorities on *Descartes' Meditations* will provide an online resource, and in addition be available for consulting and discussion. It will be common for instructors to expect students to consult with online experts in any of a myriad of fields while preparing for assignments or doing background research.

Some online communities are already adopting this approach. A site called *The Mining Company* hires 'guides' to provide information and links in specific subject areas. At a site called *Suite101*, the same function is performed by 'contributing editors'. Both sites take a magazine-like approach to these subject areas, however, as technology and their understanding evolves, these sites will become more service oriented and less display oriented.

Schools will not be their only customers. Government and business often require research in particular subject areas. People also access such resources out of curiosity or interest. Most likely a multi-tiered pricing strategy will evolve, with varying levels of service. Agencies wishing a full consulting service, including customized research, will pay a much higher rate than the casual browser (who in most cases will probably pay nothing). Schools will fall into the mid range.

Instructional Management Systems

The task of coordinating student progress through various learning materials, tracking their grades, and facilitating interaction will fall to a class of software applications known generically as instructional management systems. An instructional management system *just is* the educational delivery (ED) system described above.

An instructional management system is the backbone or motherboard into which all educational components are plugged. It will be operated primarily by the course

instructor, who in turn will configure custom course delivery for each student he or she manages.

Such systems are already in development and have gained wide acceptance in the online educational community. Examples include Virtual U, Top Class, Web CT, and many others. The systems just described differ from *conferencing* systems in that they *manage* online education, as opposed to merely facilitating some aspect of it.

IM systems will become as large and as important as Windows is today. They will be one of the major instances of computer specialization; they will be the engine which powers PADs insofar as PADs are used for education, and online educational services.

The development of open standards for IMS systems will have several consequences. First, the offering of available IMS systems will be split neatly in half, as those not meeting the standards will wane (much as Macintosh has waned). Next, a proliferation of IM systems and system components will occur, as developers create their own versions of education-compatible chat engines, discussion arenas, and backbone systems. This will cause the price of IM systems to drop dramatically. One or a few inexpensive IM backbones will become ubiquitous, the character of an online educational offering determined by the selection of plug-in modules and the skill of the instructor.

Conferencing systems, now being touted as the solution for online learning, will be discarded as expensive and inefficient. In order to function as an IM backbone, a system needs to support a wide variety of educational objects. Conferencing systems accomplish none of this; they are in the end nothing more than tools used for distance communication.

As such they are great, but online learning - as instructors are increasingly discovering - requires much more support than a mere communications tool. For online learning requires a highly structured sequencing of learning activities and online resources, It is too easy to become otherwise lost or distracted in an online environment. Students, as mentioned above, will require pacing.

Producing that level of support on a case by case basis utilizing an online conferencing system will prove too taxing for even the most dedicated of instructors. Even though conferencing systems support document management and dispersal, they do automate such essential features as pacing, course structure, interaction with remote educational objects, or course customization.

Some online conferencing tools will evolve to meet educational needs, and will in the process become IM backbones. Others will not, and will be used primarily for groupwork and conferencing (the application for which they were designed in the first place). At best, conferencing systems will plug into and communicate with IM backbones. They will support online education, but they will not *deliver* online education.

Content Filtering will be one of the major tasks of instructional management systems. Surf Watch - and other programs of that ilk, such as CyberPatrol - are clumsy initial attempts to perform a task with will be required in the future: channeling children's browsing patterns into safe areas of the internet.

I say clumsy, because the methodology is clumsy. There are two major screening systems employed by such systems: first, (editable) lists of words and word fragments the presence of which in a website (or chat, or email) will prevent that website from being uploaded, and second, (editable) lists of approved and/or disapproved sites.

The method is clumsy because it often screens inappropriately (for example, most sites on breast cancer fail the test) and because it scans text only (thus allowing unwanted images, audio clips and videos through). Additionally, in places where filters have been employed in high traffic areas (such as Yahoo Chat), an alternative language quickly develops, one which circumvents the screening software. Thus, for example, one sees chatters talk about cyber s<>x.

With the development of XML and online objects, websites of the future will become much more sophisticated, and so will the way in which the internet is used in schools. Clients used by students will not offer full internet access, the way Netscape does today. Instead, these will interact directly with (thousands of) educational servers. The servers will not deliver web pages so much as they will deliver educational objects.

The primary motivation for the system just described will not be to restrict access to unseemly materials, but rather, to ensure that educational content developers are paid for their work. An educational client accessing an educational object will, in the process of that transaction, initiate a microbilling to the institution accessing the educational object. These systems, although they will use internet technology, and indeed be accessible from the internet generally will nonetheless form a closed system.

In such an environment (and especially when the resources available number only in the tens of thousands, rather than hundreds of millions), content is easily assessed prior to use. Instructors will preview materials online, select those the content of which is appropriate for children (or young adults, or whatever), and link their courses into those materials.

Educational object metadata will probably include ratings, however these will be seen more as a guideline than a regulation. Educational jurisdictions, through their instructors and administrators, will decide for themselves what is appropriate for their students. Especially with the proliferation of private, religious and cultural schools, these standards will vary widely. In addition, parents will also be able to screen all materials selected for their children and opt to restrict resources or select alternatives.

Of more use to instructors will be metadata describing the resource's educational content, skill level, and cost for usage. This information will also help parents screen materials and select alternatives.

The question of what the 'censors' will allow students to read may have been applicable in the past, when all students used the same learning resources, and these resources were available in public forums such as the school library. But it will have no relevance in the future, where content selection will be handled on a case by case basis by parents, instructors, and educational institutions.

The Economics of Online Learning

Two different schools of thought dominate discussion on the economics of online learning. On the one hand, there is the hope that online learning will reduce costs by increasing the number of students an instructor can manage. This would be accomplished by such means as auto-marking and automized record keeping. Additionally, on this view, online learning would eliminate the need for expensive classrooms and infrastructure.

On the other hand, there is the empirical data, which suggests that online learning is *more* labour intensive than traditional classroom learning, which drives costs up. Online students typically interact to a much greater degree than traditional students, and they tend to expect more detailed and individualized comments. Additionally, the cost of developing online courses is high; it is not uncommon to see course development costs in the range of $50,000 to $100,000.

These appear to be contradictory trends, however, the resolution of that contradiction may
be found in the following observations: first, while online learning will be more expensive in the short term, it will be cheaper in the long term, and second, while educational institutions will realize some savings by offering courses online, the greater share of the
saving will be realized by students.

In the short term, costs will be high. There is no getting around that. Significant startup costs may be identified.

The cost of internet infrastructure, including an internet server with software, and a high speed internet connection. These technologies are currently expensive, but will drop dramatically as computers and internet access become cheaper.

The cost of online course development is higher initially than in the long run. Even though course modules may be re-used, they must be created in the first instance of their use. Similarly, instructional management software must be purchased and designed, and configured.

The human cost, both as needed for course development, and also, as needed for training and learning how to work in the new environment, is higher at first.

Additionally, costs will remain high so long as the internet is used to provide course delivery as it is traditionally conceived. So long as students are grouped in classes, and offered standardized courses, costs will remain high because of the inefficiencies inherent in traditional course delivery.

Improved Automation will also result in savings, especially over the long run as automation improves, however again, automation will not result in the significant savings projected in some quarters, for the following reasons:

Instructors will still be needed - a lot. Although automation will make it possible to deeply personalize instruction, the *personal* aspect of personalized instruction will in the short term only be deliverable by the instructor, both because of students' psychological needs for human intervention, and instructors' superior capacity to communicate with humans.

While many proponents of automation are thinking in terms of auto-marked assignments, and while indeed some savings may be found in this area, auto-marked assignments are not the panacea they are often perceived to be.

Automation is not automatic. As institutions which have installed management systems have discovered, automatic systems need a lot of maintenance and configuration. Online tests must be designed and routinely evaluated to ensure their accuracy. Offline testing in skills development and higher cognitive achievements will still be required. Testing must still be proctored, at least for as long as no good means of establishing student identity can be found.

In the longer term, as online course delivery and internet technology matures, costs will drop dramatically.

Capital savings will be realized over the long term as classrooms need not be built or maintained.

High speed internet access and server computers will decline dramatically in cost. Online course development will get cheaper as designers and institutions are able to use previously developed resources. Designer and instructor efficiencies will improve as they become more familiar with the online environment.

The cost of course offerings will decrease as courses are increasingly personalized, because instructor communications will become less frequent and more focused. The most significant savings will be realized as the class and course based models are abandoned.

Hiring and Payment for online instructors will little resemble the model in place today. This will cause a *lot* of controversy, especially among staff at traditional institutions.

As class based learning is displaced by traditional learning, instructors will no longer be assigned classes, but rather, individual students. Permanent, full-time staff will be assigned a teaching load consisting of a certain number of students. More common will be instructional contracts where the number of students is variable, and instructors paid according to the number of students they actually teach.

Staff at traditional institutions do much more than teach students. Especially at universities, but in educational institutions generally, they conduct research, prepare course and lesson plans, attend policy meetings, and participate on committees. Even in class, a significant proportion of their time is spent, not teaching, but rather, attending to administrative and student management details.

All of these functions will be eliminated to a large degree from the duties of instructional staff. And while the rate of pay for teaching will remain high (in fact, it will likely increase), instructors will not be paid at that rate for time they are *not actually teaching*.

This will be only one consequence of the coming *fragmentation* of educational tasks. Some tasks, especially administrative tasks, will be handled by online systems staffed by clerical staff. Payment for research will be separated from payment for instruction; more research will be paid for directly though government or corporate grants, or conducted at separate research institutions.

Student payments of fees and other expenses will vary on an institution by institution basis, but several components may be identified.

First, students will be required to pay for local facilities, such as their community learning centre and facilitator. Models here will vary, tending from community supported facilities, paid for by government or corporate grants, to user pay facilities, paid for on an as used basis.

Students will also be expected to pay for their internet access, and their PAD.

As students sign up for instruction from provider institutions, they will be assessed fees comparable to tuition fees today. Typically these fees will be paid online or at the community learning centre.

Finally, built in to the cost of the course or added as a surcharge will be the cost of educational resources offered by private providers. For example, if they are required to use the *The Road Not Taken* resource, the cost for using this resource will either be charged to the educational institution, or charged directly to the student.

Student Savings. As mentioned above, the largest beneficiary of online education will be the students, for a variety of reasons.

First, students will no longer need to travel for education. This may be only a small savings if the institution attended may be reached by the crosstown bus. It is a significant savings if the student does not need to travel to, and find lodgings in, a distant city.

And second, students will no longer need to give up their earning potential while studying. Today, a college or university degree is a full time commitment, during which the greatest expense is not tuition or even housing, but rather, the cost in lost wages. Online learning allows a student to continue to work while learning.

Finally, third, online educational offerings ought to get cheaper as institutions pass on the savings realized to students.

The Bottom Line for educational institutions is this: even though savings will not be as great as anticipated, it will be necessary for institutions to offer their courses online - and sooner, rather than later - because the costs of not doing so are too great.

As more and more courses are offered online at costs equal to or less than traditional delivery, community learning centres will begin to support these courses, and students will begin taking this. This will cause a drift in attendance from traditional classroom based course offerings. Institutions which do not offer online learning will lose a significant percentage of their student base.

It is easy to say - and surveys continue to reinforce - the idea that classroom based education is the best form of learning. As online technology improves, that will be increasingly less so, and as the savings *to the student* begin to improve, the classroom method will look less and less appealing.

Once committed to online learning, institutions will have to measure well against global competition. One factor in this will be cost, and it is for this reason the class-course model will be abandoned, as described above. And the other factor will be service. Students will want personalized, humanized instruction.

The Future

Today, and for the last century, education has been practised in segregated buildings by carefully regimented and standardized classes of students led and instructed by teachers working essentially alone.

In ten years, this model will be seen in many quarters to be obsolete, and a new model, where education is practised in the community as a whole, by individuals studying personal curricula at their own pace, guided and assisted by community facilitators, online instructors and experts around the world.

The educational experience will be rich and diverse, supported by interesting and engaging educational software, and enhanced by discussion and collaboration with people from around the planet.

Some instructors will form personal and supportive relationships with their students, acting as guides through the wealth of available material. Others will opt to become masters of their domain, acting as experts and resources, serving not only students but society as a whole.