



## CHAPTER 6

# TECHNOLOGIES OF ONLINE LEARNING (E-LEARNING)

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### INTRODUCTION

This chapter includes an examination of some of the most exciting technologies and features used in online instruction today, and those we may use tomorrow. Education is one of the fastest-growing economic and social sectors in the world, and the use of new technologies is an integral and driving component of that growth. Multimedia applications have long been popular on the Web, and these combined with streaming audio and video podcasts, such as the myriad music sites or video sites like YouTube, are opening up different opportunities for educators. Audio chat using Skype has become common, and web conferencing is used for teaching and for creating podcasts. Other useful applications in this chapter include instant messaging and peer-to-peer file sharing. The possibilities of using the new hand-held third-generation mobile technologies are also explored along with blogs, RSS, wikis, learning objects, digital games, and virtual worlds.

Many of these applications are seamlessly combined in the latest social networking sites such as Facebook, MySpace, and Bebo. These sites allow students, in classes or as informal learners, to create a community online. Although the sites are public, individuals or groups can choose to close off their space, limiting it to “friends” or to their classmates.

## MULTIMEDIA ON THE INTERNET

Multimedia incorporates text, graphics, and audio media (often with real video or animations) and combines them, using a computer. Almost every personal computer built today is capable of delivering multimedia presentations for entertainment, advertising, or education. *Edutainment* is a word for applications that incorporate multimedia entertainment with educational objectives.

Multimedia on the Internet is still not an everyday reality in the same sense as multimedia on CD-ROM or DVD, which may be commonplace in the home or classroom. Internet connection speeds limit the quality and quantity of what can be transmitted. Even with wired/wireless and high-speed advances, the transmission of large sound, animation, and video files can be time-consuming and often frustrating.

With the introduction of *streaming multimedia* in the past five or six years, however, large multimedia files can now be delivered even over modem connections. Streaming multimedia is an Internet data transfer method that facilitates the transfer of audio and video files from computer to computer in a “stream.” Streamed media packets can be played as soon as the data starts arriving at the receiving computer – users do not have to wait until the full file has been downloaded. Streaming audio has been more successful than video, which has generally been limited to small picture sizes or low resolution (grainy) video projections, but as the bandwidth increases, higher quality, full-screen video becomes possible.

The key to this breakthrough is the format in which the files are distributed, or served, over the Internet. Large audio or video files are converted into a format that can be sent as a continuous stream of small pieces to a user’s computer. At the user’s end of the connection, special software interprets the stream of data and begins to play the sample. While the first part of the sample is being played, the next is being downloaded. The second sample begins seamlessly, the first is deleted,

and the third is downloaded. Using this format, hours of audio and video content can be received over a slow modem connection.

### Recommended Links

The following links provide some good examples of educational multimedia on the Web:

- Athabasca University Astronomy 230: Northern Lights/Northern Skies: <http://astro.whytespace.ca/>
- Math Open Reference – Plane Geometry: <http://www.mathopenref.com/index.html>
- Kbears (Knowledge Bears): <http://www.kbears.com/>
- National Museum of American History: <http://americanhistory.si.edu/kids/athome.cfm>
- University of Washington, EDGE streaming video web site: <http://www.engr.washington.edu/edge/streaming.html>
- Free-ed.net: <http://www.free-ed.net/free-ed/>
- Malloy, T. Understanding ANOVA Visually: <http://www.psych.utah.edu/stat/introstats/anovafash.html>

## STREAMING AUDIO

Audio was the first type of multimedia to be delivered over the Internet in a streaming format; concerts and live radio broadcasts were among the first examples of streamed audio to appear. A wide range of streaming audio formats is in use on the Web today, but while each is different in name, the basic technology remains the same.

When a sound file is prepared for streaming, it is compressed to reduce the overall size of the file. For example, a news broadcast consisting of a single recorded voice would normally be a smaller file than an orchestral sample. In some cases, compression also means that the quality of the file is affected.

Different programs are available for receiving streaming audio, each with its own proprietary sound or media format. Quality varies from format to format, but all are compatible with modem connections. Recently, these programs have become more generic, which is good news for the end user, who no longer faces the hassle of installing three different programs in order to listen to three different sound formats. Instead, the newer, more powerful media players can decode, decompress, and play a variety of proprietary sound samples.

Many of the Internet's most widely-publicized firsts have happened as a result of streaming media events. The longest continuous Internet broadcast in history was in the form of a "jam session" held during the Canadian East Coast Music Awards in Moncton, New Brunswick, in 1997; that record was bettered during the following year's ceremony (East Coast Music Association, n.d.). Producing a live, continuous stream of music (and in subsequent years, video) for over 80 hours was truly an impressive feat. Another, more widely known first was Paul McCartney's 1999 return to The Cavern, the bar in Liverpool where the Beatles first played (Fab Four, n.d.). This live broadcast over the Internet was the most listened-to sound production in Internet history.

### Educational Uses

Streaming audio is currently used as a supplement to classroom-based and online course delivery, usually in the form of prerecorded lectures, interviews with guests, student projects, samples of student classroom interaction, or sound bytes of content relevant to the course of study. For music or English composition courses, it can be used by teachers or students to record samples of their work and make them available to the teacher and other students. Streaming on demand is becoming a key feature in web-based education. For example, listen to Gustav Holst's musical interpretation of *The Planets* included in the list of recommended links given below.

### Recommended Links

- Trussler, B., Gustav Holst: The Planets Suite: <http://www.aquarianage.org/lore/holst.html>
- Internet.com News Channel: <http://www.Internet.com/sections/news.html>
- East Coast Music Association, Your Music: <http://www.ecma.ca>
- Streaming Media World: <http://www.streamingmediaworld.com>

## STREAMING VIDEO

First came radio, and then television. And on the Web, first came streaming audio, and then streaming video. When a video sample is presented in electronic format, there are many more "layers" of data to be converted and compressed than with audio alone. As a result, when this multimedia format is delivered over the Internet in a streaming

delivery system, more technical and educational issues must be taken into consideration.

Size is the first issue. Video files are much larger than audio files, and video combined with audio is larger still. Video samples also demand more processing power on the part of the receiving computer. It is relatively simple to record sound – music, voice, or both – even on a home computer. Recording video and saving it in an electronic format, however, is more demanding on hardware and requires additional software. Because of the size and other issues, video has taken longer to become an industry standard, and it is harder to find educational applications for streaming on the Web.

Receiving streaming video feeds on a home computer is not difficult. Newer versions of Windows®, Apple OS®, and Linux come with pre-installed streamers for audio and video. Generally, these streamers are sufficient for most educational applications. As is the case with streaming audio, different formats require different applications; however, most multimedia applications now available for the home market have been designed to receive both audio and video streams. Superbowl XXXV (Clancy, n.d.), held in January 2001, saw the recreational and commercial use of streaming multimedia go to new heights. Long known for its glamorous halftime shows and extremely expensive commercials, this event was different from those of past years because of the means by which the commercials were broadcast. For those unable or unwilling to sit through hours of football to see a few commercials, several online video streaming sites encoded and broadcast the commercials within minutes of their traditional broadcast. By noon of the next day, hundreds of thousands of people had a chance to see what they had missed the night before. This application illustrates how events or sequences can be decomposed to extract only the relevant components. This technique is now driving the creation of modular, chunk-sized content objects, often referred to as *learning objects*, or more precisely, as *knowledge objects*.

### Educational Uses

The stiff, unemotional “talking head” of a professor or tutor in the corner of an e-learning web page is the image that most quickly comes to mind when one considers video clip use in an online educational situation. In such a presentation, a professor or tutor delivers a prepared lecture or shows an example of a hands-on activity; however, almost any video sample with educational value can be converted to a streaming format,

and many will serve as excellent additional resources on an educational web page, for classroom courses, or for online courses delivered synchronously. When implemented wisely, video can alleviate the page-turning boredom of many online courses. The LearnAlberta.ca project, included in the list of recommended links below, is an example of an educational video streaming project with a variety of video-based curricula for Alberta teachers and students. This project was established to define and deploy a prototype K–12 application.

### Recommended Links

- YouTube: <http://www.youtube.com/>
- University of Washington, EDGE, Streaming Video Site: <http://www.engr.washington.edu/edge/streaming.html>
- CyberTech Media Group, Streaming Video over an Intranet: <http://www.cybertechmedia.com/intranet.html>
- MP3, Top 40 Charts: <http://www.mp3charts.com>

## AUDIO CHAT AND VOICE-OVER INTERNET PROTOCOL

Text chat has long been a popular feature of the Internet. Within the past decade, audio chat has also emerged and become quite popular (Romero, 2000). Point-to-point audio connections can be made between almost any two computers on the Internet, and some Internet service providers (ISPs) and online services are now offering free Internet-based long-distance service that connects individuals calling through a personal computer to the public telephone system.

Although the robustness of Internet phone calls, or Voice-over Internet Protocol (VoIP), is currently somewhat inferior to that of dial-up long-distance telephone, consumers are increasingly attracted to Internet telephony. Most of the time, the quality is very high, and the price is free when calling computer to computer, or extremely cheap when calling telephones. The success of *Skype* and other *VoIP* services is due to the relative simplicity of making a call, requiring only an Internet hookup, headphones or speakers, and a microphone. After signing up with an Internet telephony provider, users can make local or long-distance calls to people with any type of phone. However, since voice transmissions are carried over the Internet in small packets, in the same manner as data transmissions, conversations can be subject to delays. Without a high-speed Internet connection, the quality of an Internet

call can deteriorate affecting the robustness of the call, but companies are working to improve it.

### Educational Uses

Classroom-based, email pen pal programs have been used for a long time as a way of making intercultural connections between schools. Internet telephony will add an opportunity for students to speak to others in their age group, almost anywhere in the world. It will therefore facilitate more fluid and natural communication between different cultural groups, and will be especially useful for foreign language exposure and practice.

Teacher or tutor and student communication can be greatly enhanced by opportunities to speak with one another, to discuss an assignment or a difficult concept without the expense of long-distance tolls. An electronic blackboard can be used along with VoIP for synchronous teaching. This practice is known as audio-graphic teleconferencing. Microsoft's NetMeeting is can be used in this manner.

### Recommended Links

- Skype: <http://www.skype.com/>
- ICUII.com. ICUII Video Chat (I See You Too, audio and video phone): <http://www.icuii.com>
- PC-Telephone.com: <http://www.pc-telephone.com>
- Microsoft Corp., NetMeeting: <http://www.microsoft.com/windows/netmeeting>

## WEB CONFERENCING

Web conferencing is a form of graphic teleconferencing, used in combination with VoIP as a single tool in general web applications that support real-time collaboration. The “whiteboarding” feature emulates writing or drawing on a blackboard. With a whiteboard, both teachers and learners can create, manipulate, review, and update graphical information online in real time while participating in a lecture or discussion. Using a mouse, an electronic stylus with a tablet, or even a large electronic classroom-sized whiteboard, users can annotate by writing, cutting and pasting, or clicking, dragging, and dropping. In web conferencing, content can be saved and used in future presentations. Imported graphics can be used as underlays that the user can trace over, using an “onion-skin,” “placed” on top of the image; for example, routes can be drawn

and redrawn on maps. The providers listed in the Recommended Links section below sell or rent virtual classrooms, with size (i.e., number of simultaneous logons permitted) determined by the license and the bandwidth available at the central site. These products are now incorporating small video images, “web safaris” in which the teacher leads the class to visit various sites, and application sharing which allows any of the distributed users to control a single application.

### Educational Uses

These audio and graphics-enhanced web conferencing applications allow for the emulation of classroom lessons. Students in different locations can participate actively and collaboratively with the teacher and with other students in the creation and adaptation of graphical information. This application is particularly appropriate for brainstorming sessions.

### Recommended Links

- Saba Centra Software, Inc. Saba Centra.com: <http://www.saba.com/products/centra/>
- Elluminate, Inc., Elluminate.com: <http://www.illuminate.com>
- Luidia Inc., eBeam: <http://www.e-beam.com>
- WBD Whiteboard (open source): <http://www-mice.cs.ucl.ac.uk/multimedia/software/wbd/>

## INSTANT MESSAGING

ICQ (I seek you), a commercial product distributed freely over the Net, can be described as an Internet paging device. It has some similarities to other modes of text-based communication, such as email or Internet Relay Chat (IRC). ICQ allows short messages to be sent electronically from computer to computer. As with email, the messages are stored on a central server until the recipient collects them; however, ICQ is more dynamic, in that it shows all of the group members when the recipient logs on. Thus, the exchanges are often very rapid and work much like synchronous text exchanges. Attachments and web addresses (URLs) can also be sent. Unlike email, however, ICQ also allows group chat sessions to be opened and voice chats to be established. In addition, and unlike most email systems, ICQ is highly transportable: a user could have ICQ on a computer at work, at home, and on a laptop, and receive “pages” only on the active computer.

ICQ is one of a growing number of instant messenger services that are available online. Users can also choose from MSN Messenger (MSN.com), AIM, and a bevy of similar applications. ICQ has been popular for some time, especially with technically proficient Internet users. More recently, because of the capacity of central servers, immediate and delayed message delivery, and increased functionality, instant messaging has become a popular choice for millions of users.

### Educational Uses

Instant messaging has not yet been used as an efficient content-delivery teaching tool. Its strength lies in its ability to facilitate immediate contact with other students and teachers, or with a tutor who is supervising chat sessions.

### Recommended Links

- ICQ, Inc., ICQ: <http://www.icq.com>
- MSN.com, MSN Messenger: <http://messenger.microsoft.com>
- AIM Instant Messenger: <http://www.aim.com/>
- Instant Messaging Planet: <http://www.instantmessagingplanet.com>
- International Engineering Consortium, Instant messaging (tutorial): [http://www.iec.org/online/tutorials/instant\\_msg](http://www.iec.org/online/tutorials/instant_msg)

## HAND-HELD AND WIRELESS TECHNOLOGIES

Imagine the power of the Internet in the palm of your hand, using a Portable Digital Assistant (PDA), a third generation (3G) mobile phone, or even an iPhone®. Wireless technologies, cellular modems, and hand-held devices are moving from elite gadgetry into the mainstream. How will this cord-free revolution change how we work and learn? Hand-held devices are very powerful small computers. They are now used not only for voice communications, but also for listening to music, downloading email, sending Short Message Service (SMS) messages, and surfing the Web. Some are now using mobile devices to pay bills or pay for soft drinks at dispensing machines. Many people are choosing mobile devices over desktop computers. These include ultra-notebook computers, e-books, web pads, and tablet computers.

Mobile computing has arrived. Already, wireless devices are being chosen over desktop and even laptop computers, not only as the preferred

Internet access tool, but also for common computing applications such as word processing and spreadsheets. These devices are disguised as telephones, tablets, e-books, and web pads, and now include a web browser, an instant messenger, and an email feature, along with other functions.

So your next computer probably will not be just a computer. It will also be a phone and an organizer, and will include other serious and gaming applications. You will use it to check your bank balance, buy groceries, and bet on the lottery. Cordless devices, pocket PCs, and PDAs are the wallets, cheque books, calculators, and Rolodexes of the 21st century. The size of a calculator (or even smaller), these devices are capable of basic computing tasks such as handwriting-recognition text processing and contact management. More complex and higher-end hand-helds have multimedia capabilities, wired or wireless Internet access, and the ability to send and receive data and text alike. With the advent of infrared networking, these hand-held computer devices can offer students and teachers a previously unknown degree of flexibility.

Athabasca University is preparing for the mobile and wireless world with its digital reading room, that has made course-related library materials accessible to a wide variety of mobile devices. And the AU English Second Language project has put a full basic English grammar course on the Web, accessible to mobile devices.

### Educational Benefits and Uses

As affordable access to high bandwidth increases, and the cost of wireless devices that can incorporate all the features of a PC decreases, the educational possibilities are unlimited. It might mean the end of paper-based teaching and learning, lost homework, missing tests, and costly textbooks. In the Philippines, for example, people living in rural environments, even in communities without electricity, are using their cellular phones for text-based digital messaging. Newer applications for small devices are opening up the possibility of using wireless to deliver graphics and video to users, no matter where they are. Learning becomes universally accessible.

### Recommended Links

- PDA Verticals Corp., pdaED.com: <http://www.pdaed.com>
- Palm Inc., Palm Products: <http://www.palmone.com/us/products/>
- Tucows, Mobile/PDA (PDA and handheld device software): <http://tucows.com/PDA>

- Athabasca University Digital Reading Room: <http://library.athabascau.ca/drr/>
- Athabasca University ESL Grammar: <http://eslau.ca>

## PEER-TO-PEER FILE SHARING

Perhaps the most publicized Internet event in the past couple of years has been the controversy surrounding peer-to-peer, or file-sharing, applications. Peer-to-peer applications allow users, regardless of location or connection speed, to share practically any kind of file with a limitless population of other Internet users. In contrast to the currently predominant client-to-server model, where users retrieve information from a centralized server, the peer-to-peer model allows members of its “community” to transfer files directly between users, without having to access or be constrained by a centralized server.

Of all the peer-to-peer (P2P) applications, Napster became the most well known, because of its popularity and its ultimate demise in the courtrooms. Napster became prominent because of its focus on facilitating the distribution and sharing of files, and especially of copyright-protected media (mainly music files) encoded in the MP3 format. While P2P software and services have been considered mainly a means of downloading music files, the technology and goals behind the peer-to-peer concept allow for much more wide-ranging uses.

Andy Oram, editor of *Peer-To-Peer: Harnessing The Power of Disruptive Technologies*, notes that communities on the Internet have been limited by the flat interactive qualities of email and network newsgroups, and that users have great difficulty commenting on each other’s postings, structuring information, and so forth. As such, he recommends the use of peer-to-peer applications with structured metadata for enhancing the activities of almost any group of people who share an interest (Oram, 2001).

### Educational Uses

It is easy to make connections between learning objects, intelligent educational systems, and the peer-to-peer model. Research and other materials can easily be offered online and “harvested” by a well-designed P2P program, offering students or teachers a wealth of knowledge that might not otherwise be available.

### Recommended Links

- Napster (the infamous P2P application): <http://www.napster.ca/>
- Audiogalaxy: About the satellite (the next generation of P2P): <http://www.audiogalaxy.com/satellite/about.php>
- Kazaa Media Desktop (P2P continues): <http://www.kazaa.com/us/index.htm>

## BLOGS (WEB LOGS)

Blogs are becoming very popular. They are generally personal journals or newsletters that are more or less frequently updated by the owner. Most blogs are available to the general public. Blogging software exists so that people who are not technically sophisticated can maintain one without difficulty. Blogs range from the deeply philosophical to the mundane, from the generic to those dedicated to very specific issues, such as sports, politics, or travel. Many blogs serve as mini-portals, containing links of interest to the blog owner, or to the community which they serve; these are sometimes called *linklogs*. Visitors to a blog site can normally add comments and ideas. Blogs can serve as effective communications tools for people who wish to maintain connections. Although primarily text-based, some blogs can support different types of media, including audio and video. One of the most popular is the *vlog* or *video blog*. Other blogs define themselves by the type of device, such as specialty blogs for PDAs or other mobile devices.

### Educational Uses

Blogs have many uses in education, including their importance for knowledge sharing in any specific subject area, either with other students, the instructor, or external professionals. Blogging can also provide key networking opportunities between students and with outside professionals in the field. Blogs can also be used by teachers for assigning coursework, and serve as a place for students to submit their work. Course announcements and annotated links to readings, along with advice on how to approach their studies, can also be delivered using blogs. Blogs are used successfully in creative or reflective writing courses, and in courses that require journals or e-portfolios. And they also provide students with experience in real-world digital knowledge management, working with groups, and information sharing.

### Recommended Links

- Edublogs: <http://edublogs.org/>
- Blogdigger.com: <http://www.blogdigger.com/>
- Technorati.com: <http://technorati.com/>
- University of Houston. Blogs in Education: <http://awd.cl.uh.edu/blog/>

## RSS AND ATOM FEEDS

Rich Site Summary or Really Simple Syndication (RSS) is a subset or protocol of the XML programming language that supports the distribution of content over the World Wide Web. RSS *aggregators* are computer programs which subscribe to a feed through a hyperlink that checks relevant sites for new content. RSS is heavily used for delivering news items, comments, descriptions, or images to subscribers, and enables the personalization of news items, by allowing a user's computer to fetch information that is of interest, using their PC, notebook, PDA, or mobile phone. This information can be tracked and personalized, using RSS. It facilitates access to the vast store of information that is increasing daily on the Web. Rather than having to go and search specific web sites or blogs, RSS sends the information directly to the user's web site as it becomes available. Atom is a proposed standard that attempts to overcome the problem of incompatible RSS formats with poor interoperability.

### Educational Uses

Sharing of information with other teachers is probably one of the main uses of RSS for educators. As content is updated, relevant teaching content can be aggregated in a timely fashion. From one site, information will be available to view from a wide variety of relevant sources, including podcasts and videocasts. More recently, RSS feeds have been used to support social networks of students with peer-produced content. Another area for RSS sharing is in open-source productivity applications and educational games.

### Recommended Links

- RSS – A quick start guide for educators by Will Richardson: <http://weblogg-ed.com/wp-content/uploads/2006/05/RSSFAQ4.pdf>
- RSS Ideas in Education: [http://www.teachinghacks.com/wiki/index.php?title=RSS\\_Ideas\\_in\\_Education](http://www.teachinghacks.com/wiki/index.php?title=RSS_Ideas_in_Education)

- RSS, The next killer app for education by Mary Harsch: <http://technologysource.org/article/rss/>
- Feedster: <http://www.feedster.com/>
- Syndic8: <http://www.syndic8.com/>

## WIKIS

A wiki is a web site or, more accurately, a collection of web sites where users can insert and edit content collectively. Users can also insert relevant hyperlinks, using a simple markup language. A wiki exists on an easy-to-use database and is normally maintained by the user community. Many wikis are open to the public, although some are closed and require users to log in. *Wikipedia* is the best-known wiki.

### Educational Uses

Wikis can be used effectively by instructors for posting course information or lecture notes and inviting participation from students. These notes can be distributed in the form of simple text, PowerPoint slides, or audio and video components. Students can participate by adding their own notes and comments, along with relevant links that they may have found, creating a discussion environment for a particular topic. Students or groups of students can be invited to create their own wiki, either with personal information or project information related to the topics being studied. Wikis can also be used as e-portfolios of students' work, for evaluation by the instructor. Brainstorming activities can be especially powerful using a wiki, and FAQ pages are also possible.

### Recommended Links

- Wikipedia: <http://www.wikipedia.org>
- Curriki: <http://www.curriki.org>
- Wikiversity: [http://en.wikiversity.org/wiki/Wikiversity\\_Reports](http://en.wikiversity.org/wiki/Wikiversity_Reports)
- Wiki Pattern's Blog on Wiki use in Education: <http://www.ikiw.org/>
- Wikiineducation.com's A Wiki book: <http://www.wikiineducation.com/display/ikiw/Home>

## VIRTUAL WORLDS

Virtual worlds are sometimes referred to as 3D Internet or *metaverses*. Perhaps the most well-known example is *Second Life*, which is used by

millions of people. A virtual world is a simulated environment that exists on a server and is accessed by users via the Internet. Users interact with *avatars*, which are simulated characters that may or may not resemble the actual user. Normally, virtual worlds are inhabited by many users simultaneously. Real-time communication is possible in these worlds, using VoIP or live video. Virtual worlds are used for massive multiplayer gaming, particularly role-playing games.

### Educational Uses

Virtual worlds can be exploited by educators who are interested in flexible environments that are limited only by the imagination. Learning can be promoted in these worlds using traditional methods, such as lectures and other classroom-based types of activities, or through computer-based simulations, new media applications, electronic gaming, and other forms of experiential learning. Learners can practice skills and try out new ideas in a safe environment, and thus learn from their mistakes without adverse consequences. Students and instructors from anywhere in the world can participate together in these simulated worlds.

### Recommended Links

- Virtual World Comparison Page: <http://oz.slinked.net/compare.php>
- Second Life: <http://secondlife.com/>
- ActiveWorlds: <http://www.activeworlds.com/>
- Open Source Metaverse Project: <http://metaverse.sourceforge.net/>

## DIGITAL GAMES

Computer games are very popular. The most popular types include shoot-em-ups, racing, and sports games that normally include two or more simultaneous players. Games which are used extensively in education include puzzlers, crosswords, sudoku, and types of chess. Role-playing games require users to adopt a character who must reach an end goal, typically by overcoming obstacles and traversing several levels. Strategy games are used for military training as well as for entertainment.

## Educational Uses

Educational games are becoming very popular. For the most part, educational games today are used to reinforce learning that has been introduced in traditional ways. Games reinforce learning by their ability to offer immediate feedback and recurring gratification. In addition, they can be used to support students who learn differently. They prolong the interest of learners, keeping them on task while reinforcing the concepts taught. Above all, games motivate learners by making learning enjoyable.

## Recommended Links

- Learning Light: e-Learning Centre, Games-based Learning: <http://www.e-learningcentre.co.uk/eclipse/Resources/games.htm>
- Prensky, M. *Twitchspeed*: <http://www.twitchspeed.com/site/news.html>
- Carlton College's Game-based Learning: <http://serc.carleton.edu/introgeo/games/index.html>

## LEARNING OBJECTS

*Knowledge objects* are discrete items that can be integrated into lessons as, for example, a text, graphic, audio, video, or interactive file. *Learning objects* are more highly developed, consisting of discrete lessons, learning units, or courses. For example, a video clip from a speech is a simple knowledge object, but it becomes a learning object when a lesson is added to it. Many different learning objects can be created from one such component; for example, lessons in politics, history, ethics, media studies, and many other subjects could be created from a single video clip. They could subsequently be made available in online databases, using international standards for efficient access by learners. Imagine having seamless access to a vast store of learning objects in the form of animations, videos, simulations, educational games, and multimedia texts, in the same way that Napster users had access to music files.

## Educational Uses

The principal benefit of knowledge and learning objects comes from their reusability. As discrete units, they can be incorporated into a wide range of courses or learning scenarios. Their standards-based

structure makes them available for use in many different learning management systems and other applications. They also appear to be pedagogically effective:

NETg compared typical expository courses with a blend of case-based learning and self-study learning objects. They found that the students who used the objects-based course enjoyed a 41% drop in the time required to complete the task that was taught. (Clark & Rossett, 2002)

### Recommended Links

- MERLOT, Welcome to MERLOT!: <http://www.merlot.org/merlot/index.htm>
- CAREO: <http://www.careo.org>
- Connexions: <http://www.connexions.com>
- Longmire, W., A primer on learning objects: <http://www.learningcircuits.org/2000/mar2000/Longmire.htm>
- McGreal & Roberts, 2001. *A primer on metadata for learning objects*: <http://auspace.athabascau.ca:8080/dspace/handle/2149/231>

## CONCLUSION

Does the Web offer us the potential to expand our classrooms and study halls beyond the school grounds, beyond provincial and national boundaries? Can our educational systems evolve into entirely new institutes that support learning by taking full advantage of the emerging technologies? Certainly, distance education and traditional correspondence courses will never be the same because of the World Wide Web. All levels of education stand to benefit from what the Internet has to offer. For educators, web participation could range from simply putting class notes and lecture materials online for absent students, to integrating dynamic online quizzing systems, to preparing classes for upcoming tests and examinations, all the way to enabling learners to participate in highly interactive, true-to-life simulations and games.

With the evolution of more user-friendly applications and interactive content encapsulated in learning objects, one need not be a coding expert to take advantage of the learning opportunities that are becoming available on the Web. Many instructors and learners are already

bridging the divide by using hybrid access and delivery models, complete with an Internet component. As the cost of hardware, software, and telecommunications declines, even developing countries can look forward to a future where access to the wealth of the world's knowledge is commonplace. The future has arrived.

## REFERENCES

- ActiveWorlds. (n.d.). *ActiveWorlds: Home of the 3D Chat, virtual reality building platform web page*. Retrieved September 1, 2007, from <http://www.activeworlds.com/>
- AIM Instant Messenger. (n.d.). *AIM 6.5*. Retrieved March 7, 2008, from <http://www.aim.com>
- AOL Canada. (2002). *AOL Instant Messenger*. Retrieved August 15, 2007, from [http://www.aol.ca/aim/index\\_eng.adp](http://www.aol.ca/aim/index_eng.adp)
- Athabasca University. (n.d.). *Astronomy 230: Northern Lights/Northern Skies web site*. Retrieved September 1, 2007, from <http://astro.whytespace.ca/>
- Athabasca University. (n.d.). Athabasca University ESL Grammar. *Athabasca University Mobile ESL web site*. Retrieved September 1, 2007, from <http://eslau.ca>
- Athabasca University. (n.d.). *Digital Reading Room*. Retrieved September 1, 2007, from <http://library.athabascau.ca/drr/>
- Audiogalaxy. (2003). About the satellite. Retrieved August 15, 2007, from <http://www.audiogalaxy.com/satellite/about.php>
- Blogdigger. (n.d.). *Blogdigger.com home page*. Retrieved September 27, 2007, from <http://www.blogdigger.com/>
- CAREO. (2002). *Campus Alberta Repository of Educational Objects (CAREO) home page*. Retrieved August 15, 2007, from <http://www.careo.org>
- Carlton College. (n.d.). Game-based learning. In *Starting point: Teaching entry level Geoscience*. Retrieved September 27, 2007, from <http://serc.carleton.edu/introgeo/games/index.html>
- Clancy, K. J. (n.d.). Super Bowl XXXV: Advertising's night of nights? In *Copernicus Marketing Communications*. Retrieved September 1, 2007, from <http://www.copernicusmarketing.com/about/superbowl.shtml>
- Clark, R., & Rossett, A. (2002, September 10). Learning solutions – learning objects: Behind the buzz. *Chief Learning Officer online*. Retrieved

- August 15, 2007, from [http://www.clomedia.com/content/templates/clo\\_feature.asp?articleid=24&zoneid=30](http://www.clomedia.com/content/templates/clo_feature.asp?articleid=24&zoneid=30)
- Connexions. (n.d.). *Connexions telecommunications web site*. Retrieved September 1, 2007, from <http://www.connexions.com>
- Curriki. (n.d.). *Curriki home page*. Retrieved September 1, 2007, from <http://www.curriki.org>
- CyberTech Media Group. (n.d.). *Streaming video over an Intranet*. Retrieved August 15, 2007, from <http://www.cybertechmedia.com/intranet.html>
- East Coast Music Association. (n.d.). *Your music*. Retrieved September 1, 2007, from <http://www.ecma.ca>
- Edublogs. (n.d.). *Edublogs home page*. Retrieved September 27, 2007, from <http://edublogs.org/>
- Illuminate, Inc. (2007). *Illuminate V.8, web site*. Retrieved August 15, 2007, from <http://www.illuminate.com>
- Fab Four. (n.d.). *Paul McCartney rocks the Cavern Club*. Retrieved September 1, 2007, from <http://www.fabfour.addr.com/paulcavern.htm>
- Feedster. (n.d.). *Feedster 2.0 beta version home page*. Retrieved September 27, 2007, from <http://www.feedster.com/>
- Free-ed.net. (n.d.). *Free-Ed.Net: Free education on the Internet web site*. Retrieved September 26, 2007, from <http://www.free-ed.net/freed/>
- Harsch, M. (2003) RSS: The next killer app for education. *The Technology Source*. Retrieved March 7, 2008, from <http://technologysource.org/article/rss/>
- ICQ. (n.d.). *ICQ homepage*. Retrieved September 1, 2007, from <http://www.icq.com>
- ICUII.com. (n.d.). *ICUII 8.0 Video Chat*. Retrieved August 15, 2007, from <http://www.icuii.com>
- Instant Messaging Planet. (n.d.). *Instant Messaging Planet home page*. Retrieved September 27, 2007, from <http://www.instantmessaging-planet.com/>
- International Engineering Consortium. (2003). *Instant messaging (Tutorial)*. Retrieved September 27, 2007, from [http://www.iec.org/online/tutorials/instant\\_msg](http://www.iec.org/online/tutorials/instant_msg)
- Internet.com. (n.d.). *Internet.com news channel*. Retrieved September 26, 2007, from <http://www.Internet.com/sections/news.html>
- Kazaa V3.2.5. (n.d.). *Kazaa P2P Desktop*. Retrieved September 1, 2007, from <http://www.kazaa.com/us/index.htm>

- kbears.com. (n.d.). *Knowledge Bears home page*. Retrieved September 27, 2007, from <http://www.kbears.com/>
- Learning Light. (n.d.). Games-based learning. In *Learning light e-learning centre*. Retrieved September 1, 2007, from <http://www.e-learningcentre.co.uk/eclipse/Resources/games.htm>
- Luidia. (1997). *eBeam*. Retrieved August 15, 2007, from <http://www.e-beam.com>
- Longmire, W. (2000, March). A primer on learning objects. *Learning Circuits: ASTD's online magazine all about e-learning*. Retrieved September 1, 2007, from <http://www.learningcircuits.org/2000/mar2000/Longmire.htm>
- Malloy, T. (2000). Understanding ANOVA visually. *University of Utah Faculty of Psychology*. Retrieved September 1, 2007, from <http://www.psych.utah.edu/stat/introstats/anovaflash.html>
- Math Open Reference. (n.d.). *Plane geometry*. Retrieved March 7, 2008, from <http://www.mathopenref.com/index.html>
- McGreal, R., & Roberts, T. (2001). *A primer on metadata for learning objects: Fostering an interoperable environment*. Retrieved April 29, 2004, from <http://auspace.athabascau.ca:8080/dspace/handle/2149/231>
- MERLOT. (n.d.). Welcome to MERLOT! *Multimedia Educational Resource for Learning and Online Teaching (MERLOT) home page*. Retrieved September 1, 2007, from <http://www.merlot.org/merlot/index.htm>
- Microsoft Corporation. (n.d.). *NetMeeting*. Retrieved September 1, 2007, from <http://support.microsoft.com/ph/2457>
- MP3.com Inc. (n.d.). *Top 40 charts*. Retrieved September 1, 2007, from <http://www.mp3charts.com>
- MSN.com. (n.d.). *MSN Messenger*. Retrieved September 1, 2007, from <http://webmessenger.msn.com/>
- Napster, LLC. (n.d.). *Napster*. Retrieved September 1, 2007, from <http://www.napster.ca/>
- National Museum of American History. (n.d.). Kids: Things to do at home. *National Museum of American History web page*. Retrieved September 27, 2007, from <http://americanhistory.si.edu/kids/athome.cfm>
- NeoPlanet, Inc. (n.d.). *NeoPlanet Browser*. Retrieved September 1, 2007, from <http://www.neoplanet.com/site/products/browser.html>
- Open Source Metaverse Project. (n.d.). *Metaverse open source software project homepage*. Retrieved September 27, 2007, from <http://metaverse.sourceforge.net/>

- Oram, A. (Ed.). (2001). *Peer-to-peer: Harnessing the power of disruptive technologies*. Sebastopol, CA: O'Reilly and Associates.
- Palm Inc. (n.d.). *Palm products*. Retrieved September 1, 2007, from <http://www.palm.com/us/products/>
- PC-Telephone.com. (n.d.). *PC Telephone web site*. Retrieved September 1, 2007, from <http://www.pc-telephone.com>
- PDA Verticals Corp. (n.d.). *pdaED.com*. Retrieved September 1, 2007, from <http://www.pdaed.com/vertical/home.xml>
- Prensky, M. (n.d.) *Twitcheed: Reaching younger workers who think differently*. Retrieved March 7, 2008 from <http://www.marcprensky.com/writing/Prensky%20-%20Twitch%20Speed.html>
- Richardson, R. (2005). *RSS – A quick start guide for educators*. Retrieved September 27, 2007, from <http://weblogg-ed.com/wp-content/uploads/2006/05/RSSFAQ4.pdf>
- Romero, S. (2000, July 6). IP: Millions phoning online: Price is right even if quality isn't. *New York Times*, C1. Retrieved September 1, 2007, from <http://query.nytimes.com/gst/abstract.html?res=F30F13FD355D0C758CDDAE0894D8404482>
- RSS Ideas in Education. (n.d.). *Teaching Hack.com's wiki entry*. Retrieved September 1, 2007, from [http://www.teachinghacks.com/wiki/index.php?title=RSS\\_Ideas\\_in\\_Education](http://www.teachinghacks.com/wiki/index.php?title=RSS_Ideas_in_Education)
- Richardson, W. (2006). *A quick start guide for educators*. Retrieved March 7, 2008 from <http://weblogg-ed.com/wp-content/uploads/2006/05/RSSFAQ4.pdf>
- Saba Centra Software. (n.d.). *Saba Centra.com*. Retrieved August 15, 2007, from <http://www.saba.com/products/centra/>
- SecondLife. (n.d.). *SecondLife home page*. Retrieved September 1, 2007, from <http://secondlife.com/>
- Skype. (n.d.). *Skype.com web site*. Retrieved September 1, 2007, from <http://www.skype.com/>
- Streaming Media World. (n.d.). *Streaming Media World.com web site*. Retrieved September 1, 2007, from <http://www.streamingmediaworld.com>
- Syndic8.com. (n.d.). *RSS 2.0. Syndic8.com home page*. Retrieved September 1, 2007, from <http://www.syndic8.com/>
- Technorati.com. (n.d.). *Technorati.com web site*. Retrieved September 27, 2007, from <http://technorati.com/>
- Trussler, B. (1995). *Gustav Holst: The Planets Suite. AquarianAge web site*. Retrieved September 1, 2007, from <http://www.aquarianage.org/lore/holst.html>

- Tucows. (n.d.). *Mobile/PDA*. Retrieved September 1, 2007, from <http://tucows.com/PDA>
- University of Houston. (n.d.). *Blogs in education*. Retrieved September 27, 2007, from <http://awd.cl.uh.edu/blog/>
- University of Washington. (n.d.). *Education at a Distance for Growth and Excellence (EDGE) Streaming Video*. Retrieved September 1, 2007, from <http://www.engr.washington.edu/edge/streaming.html>
- Virtual World Comparison Page. (2004). *Oz World's Virtual World Comparison web page*. Retrieved September 27, 2007, from <http://oz.slinked.net/compare.php>
- WBD Whiteboard. (n.d.). *Department of Computer Science, University College London*. Retrieved August 15, 2007, from <http://www-mice.cs.ucl.ac.uk/multimedia/software/wbd/>
- WikiinEducation.com. (n.d.). Using wikis in education: A wiki book. *Wikineducation.com web site*. Retrieved September 27, 2007, from <http://www.wikiineducation.com/display/ikiw/Home>
- Wiki Patterns. (n.d.). *Wiki Pattern's blog on wiki use in education*. Retrieved September 27, 2007, from <http://www.ikiw.org/>
- Wikipedia. (n.d.). *Wikipedia homepage*. Retrieved September 1, 2007, from <http://www.wikipedia.org>
- Wikiversity. (n.d.). *Wikiversity home page*. Retrieved September 27, 2007 from [http://en.wikiversity.org/wiki/Wikiversity\\_Reports](http://en.wikiversity.org/wiki/Wikiversity_Reports)
- YouTube. (n.d.). *YouTube web site*. Retrieved September 1, 2007, from <http://www.youtube.com/>

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Rory McGreal is Associate Vice President, Research, at Athabasca University – Canada's Open University. Previously, he was the executive director of TeleEducation New Brunswick, a province-wide bilingual (French/English) distributed distance learning network. Before that, he was responsible for the expansion of *Contact North* (a distance education network in Northern Ontario) into the high schools of the region. His present interest in mobile learning research grows from his investigations into learning objects and standardization for interoperability among different applications and devices. He is leading efforts at AU to build a learning object repository that will facilitate data output to a wide variety of mobile devices.

In the past, he has worked in Canada as a teacher and teacher representative, and abroad in the Seychelles, the Middle East, and Europe in various capacities, as a teacher, union president, ESL technological training co-ordinator, instructional designer, language and computer laboratory co-ordinator, and educational advisor. He was the recipient of the US Wedemeyer Award for excellence as a distance education practitioner.

