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NMC Horizon Project
2005 "Short List"

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Time-to-Adoption: One Year or Less

Enterprise-Level Tools for Learning

NOTE: While this collection of technologies emerged in the same way the others did, through triangulation of the various source data, interviews, and advisory board contributions, it did not generate much enthusiasm at the Denver meeting. Considering it somewhat dated and unlikely to make the next cut, the Advisory Board members present suggested we not put too much additional effort into this category.

Tools that are adopted and deployed campus- or system-wide provide explicit and implicit advantages. Apart from the obvious advantages of having a standard tool (familiarity from class to class and campus to campus; learn once/use often; simplified technical support and training; potential cost savings), large-scale deployment of systems like portals and course management systems sends a message that they should be used by campus constituents. If this message is reinforced by strong support from information technology departments and ready training for faculty, enterprise tools are likely to be accepted.

Relevance for Teaching, Learning & Creative Expression
- preparing students for a technology-intensive workplace
- making it easier to access course materials and work in groups
- facilitating access for non-traditional learners and learners in remote locations
- supporting anytime/anywhere access to content
- providing personalized services
- integrating services campus-wide

Examples

- Portals *(myU at University of Minnesota, MPortal, UCSD)*
- Digital Collections; Asset and Content Management *(MIT, OSU, Calgary, Fedora)*
- Course management systems *(Blackboard, Web CT, Sakai)*
- E-Portfolios

For Further Reading

From Static Web Site to Portal
(Christopher G. Connolly, in *EDUCAUSE Quarterly*: Number 2, 2000) Villanova University provides a case study for integrating a dynamic and individualized web system.
http://www.educause.edu/ir/library/pdf/eq/a002/eqm0024.pdf

Portals in Higher Education
(Michael Looney, in *EDUCAUSE review*: July/August 2000) This article addresses three basic questions about portals: What are portals? Why is e-commerce interested in higher education? What is the potential value of a portal for higher education?
http://www.educause.edu/pub/er/erm00/articles004/looney.pdf

A Case for Institutional Repositories: A SPARC Position Paper
(Raym Crow, White paper: The Scholarly Publishing & Academic Resources Coalition, 2002) This paper provides a review of institutional repositories (here, digital collections capturing and preserving the intellectual output of a single or multi-university community) and posits that they provide a compelling response to two strategic issues facing academic institutions: reforming the system of scholarly communication and tangibly indicating a university's quality by demonstrating the relevance of its research activities.
http://www.arl.org/sparc/IR/ir.html

Time-to-Adoption: One Year or Less

Ubiquitous Wireless

Believing in the premise that wireless connectivity should just be available anywhere, some locations such as universities, airports, and even small towns are offering the service freely to their constituents. A new generation of broadband wireless technologies, including 802.11n and 802.16 (wiMax), is emerging that will continue to support the trend of ubiquitous wireless access. Both technologies significantly increase both throughput and reach of the standard wireless mobility experience, providing faster, more cost-effective access while requiring fewer transmitters.

Relevance for Teaching, Learning & Creative Expression
Imagine the following sample scenarios *(to be replaced with actual scenarios)*:

- Students in the classroom learning about archaeology are able to access a website showing a live video feed from a dig halfway across the state, or the country. The site contains data entered only a few minutes ago by the field researchers, so students assemble field reports from the data as if they were on the dig. Later, they compare their field reports with those written by the researchers.
- A group of students and their teacher take their laptops outside on a nice day and have class outside. After an in-depth verbal discussion of the literary work the class has been reading, the teacher uses a wiki to facilitate a collaborative written analysis, right there on the lawn.
- A student returning from spring break opens her laptop in the airport and begins to refresh her memory by browsing the course website while she waits for her flight.

These and similar activities become possible and mobile computing becomes a given as technical barriers melt away. Lifelong learning is facilitated by the availability of wireless anytime, anywhere.

NOTE: Focus on the real and potential impacts of this technology on the lecture hall; another angle is the idea of device independence

Examples

Highlight examples of how freely available wireless access is currently being deployed in these and other locations, with an emphasis on learning applications:
- Universities like Dartmouth and the University of British Columbia
- Bradley International Airport, Hartford, CT
- The town of East Haddam, CT

Potential other ideas to explore: realtime polling in lecture halls without special equipment; "nomadicity"; converged wireless; voice over IP. Highlight why Wi-MAX (802.16) is so important (single tower, 30 miles) for campuses and communities.

For Further Reading

Taking WiFi to the Max
 WiMax is a lot like WiFi, but unlike WiFi's 150-foot range, WiMax has a reach of 10 miles, offering a way to bring the Internet to entire communities without having to invest billions of dollars to install phone or cable networks.
http://www.siliconvalley.com/mld/siliconvalley/business/technology/personal_technology/9831069.htm

Wi-Fi Goes to Town
Add Wi-Fi access to garbage collection and police protection as services that many municipalities now regard as essential amenities for their citizenry.
http://www.technologyreview.com/articles/innovation40704.asp?trk=nl

Time-to-Adoption: One Year or Less

Hybrid Learning (Blended Learning)

"A hybrid learning model provides students with an approach that combines face-to-face instruction and distance learning. As instructors integrate technology into their face-to-face teaching practices, the best of both types of instruction are combined to enhance the learning experience of the student. The goal is to enhance student learning by offering students a combination of face-to-face instruction and distance learning."
(From http://www.norquest.ab.ca/distance/hybridlearning.htm)

Relevance for Teaching, Learning & Creative Expression
Redesigning curricula into hybrids allows instructors to offer courses in more flexible ways. Classroom efficiency is maximized by providing students with access to web-based resources and online learning activities, affording greater learning opportunities. This helps to lessen instructor workloads, accommodate various student learning styles, and personalize the student learning experience. It also requires fewer hours of classroom time.

With course materials accessible 24 hours a day, students can access online course materials at times more conducive to their busy schedules. This makes the learning environment more flexible and accommodating to the needs of the student. Students can access materials that appeal to varying learning styles, communicate with peers and the instructor, navigate through course materials in a more self-directed style, and find information they need on their own time and in their own way with the support and motivation they would receive in a traditional classroom.

Examples

- The University of Central Florida has had an established hybrid learning component (the Distributed Learning Initiative) since fall of 1996. The results of ongoing evaluation of the courses are available (http://pegasus.cc.ucf.edu/~rite/ImpactEvaluation.html). UCF also includes a Virtual Campus (http://distrib.ucf.edu/).
- The University of Wisconsin at Milwaukee has received a grant to help faculty develop hybrid courses. A specially designed website (http://www.uwm.edu/Dept/LTC/hybrid/) explains what hybrid courses are and how to prepare to develop and teach them.

For Further Reading

Hybrid Teaching Seeks to End the Divide Between Traditional and Online Instruction
(Jeffrey R. Young, in *The Chronicle of Higher Education*: March 22, 2002) This article provides an overview of trends at selected institutions, including Pennsylvania State University, Fairleigh Dickinson University, Harvard Extension Schools, Maricopa Community Colleges, the University of Wisconsin at Milwaukee, and Ohio State University.
http://chronicle.com/free/v48/i28/28a03301.htm

A Hybrid Campus for the New Millennium
(Ron Bleed, in *EDUCAUSE review*: January/February 2001) The article discusses pedagogical and architectural considerations of hybrid teaching.
http://www.educause.edu/ir/library/pdf/erm0110.pdf

What is Hybrid Learning?
(Website) NorQuest College provides an introduction to the concept of hybrid learning.
http://www.norquest.ab.ca/distance/hybridlearning.htm

NOTE: find newer sources…

Time-to-Adoption: One Year or Less

Students' Communication Tools *(rename)*

Communication tools like cell phones, instant messaging, blogs, RSS[*], wikis, and others are used commonly by students in their personal lives. As students become more familiar with (and perhaps dependent on) these tools, they are bringing them into the classroom, albeit not always for purely academic purposes. Some learning applications will emerge naturally as a result of this process; savvy teachers who pick up on the students' use of these tools will find ways to capitalize on the critical mass that exists and introduce them into classroom teaching.

Relevance for Teaching, Learning & Creative Expression
The potential of these tools is to connect students in new ways, in new groupings, and for new purposes. Ownership of the process of discovering or acquiring knowledge may begin to move from the teacher alone into the hands of the educational group comprised of teacher and students. Collaborative workspaces, both on- and offline, will be supported by common tools that students know well.

Blogs, wikis, and other asynchronous forums encourage sharing of multiple perspectives in a safe atmosphere. Familiarity with the toolset may lead to increasingly creative approaches to learning on the part of students.

Examples

- A "New Writing" course using blogs and wikis: http://cal.bemidjistate.edu/english/blikis.html
- A collaborative student review of various blogs using specific criteria: http://caxton.stockton.edu/BlogOnBlogs/
- Small Pieces Loosely Joined, an activity space using blogs, wikis, instant messaging, audio/video chat, and other technologies: http://careo.elearning.ubc.ca/smallpieces
- Many To Many, a group weblog about social software: http://www.corante.com/many/
- *PDAs, iPods, cell phones, digital cameras, trios, blackberry – learning uses of common tools, or a separate category if there is enough of it?*
- *focus this on things that students use commonly, like IM, but that are not yet common in the learning environment*

For Further Reading

Social Lives of a Cell Phone
Say you're young and single, and you're out on the town one Saturday night. With a hot new service called Dodgeball, you take out your mobile phone and tap in the name of the restaurant where you are hanging out. You get a list of friends, and friends of friends, within 10 blocks. Social connection services like this, based on mobile wireless devices, are about to radically changes how we communicate with friends, family, and colleagues.
http://www.technologyreview.com/articles/wo_bender071204.asp?trk=nl

Classroom E-Communication
Amy Benjamin, a high school teacher at Hendrick High School in Montrose, New York, assigns students to have instant message conversations on everything from poetry to class reading assignments. "Students are all online anyway, and instant messaging is a good way to get them to analyze their own thinking," Benjamin said. "It is . . . a genuine cross between writing and speech, and students can use it to analyze and critique their own thinking."
http://journalism.nyu.edu/pubzone/livewire/000141.php

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[*] RDF [Resource Description Framework] Site Summary

Time-to-Adoption: Two to Three Years

Technologies for Searching and Finding

Intelligent agents, federated search, and the increasing sophistication of services like Google and Blinkz.com are making it easier to find – and keep track of – answers, information, and materials. Intelligent agents can take "instructions" about the types of things a person is interested in, report immediate findings, and even keep track of search parameters over time, repeating the search at intervals to add to the results. Spyware- and adware-detection software, key loggers, and website ranking utilities are also intelligent agents that search for other kinds of information.

Federated search technology allows searching of multiple archives, repositories, and databases with a single query. Technologies like RSS[*] bring tailored results right to a course web page; the live data feed keeps content fresh, piping it in from another source on the internet. Appropriate metadata (SCORM, METS, IMS) is a key part of successful searching and finding.

NOTES: Include more emerging forms of this: Google Desktop; Blinkx; Search & mine; P2P forms of searching; real time searching; searching real data sets for unexpected discoveries

Relevance for Teaching, Learning & Creative Expression
With new technologies for searching and finding, collections of course readings that were once photocopied and bound can be digital, updateable, easy to assemble, and easy to access. Material can be located in multiple repositories quickly with federated search. Intelligent agents allow the collection to grow over time as new materials are produced, enlivening course content and keeping it up to date. Advanced repositories allow digital content like images, texts, videos, and other media to be licensed for educational (or commercial) use.

Examples

Online stores of digital content for sharing or licensing:
- The Open Video Project (http://www.open-video.org/project_info.php)
- MIT's Digital Repository, Dspace (https://dspace.mit.edu)
- Cartoonbank.com (http://www.cartoonbank.com)

Intelligent agent technologies:
- ACM Digital Library Binders (http://portal.acm.org/dl.cfm - login required for binders)
- Agentland.com, one-stop shopping for all kinds of agents (http://www.agentland.com/)

For Further Reading

Sketchy Information
Looking for a book, CD, or movie recommendation? Type in the name of an author that you like at Gnooks.com and up pops a screen of other writers. But what makes the site different is that the the name you provide sits in the middle of the browser window while the suggested names are sprinkled about, quivering and dancing as though trying to elbow each other out of the way to reach the center. This is search visualization in action--and it represents a new wave of interfaces that are challenging the traditional lists of links.
http://www.technologyreview.com/articles/wo_sherman031904.asp?trk=nl

Re-Finding Stuff On the Web
(In *Technology Review*) You're sure you saw it once, somewhere online–but where? New research yields insight into how people relocate information that they've accessed before (login required to view article).
http://www.technologyreview.com/articles/rnb_021204.asp?trk=nl

WebFountain: http://www.almaden.ibm.com/webfountain/

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[*] RDF [Resource Description Framework] Site Summary

Time-to-Adoption: Two to Three Years

Open Source (as an Enterprise-Level Strategy)

NOTES: The Advisory Board members in Denver saw this category as more of an over-arching, cross-cutting trend, and suggested it be addressed in the Executive Summary.   If it goes forward on its own, limit the discussions to the ones that are relevant for teaching and learning, and describe them more fully (Fedora, Sakai; Sophia for open content; Open Archive Initiative; Lionshare).

Open source software is any software whose source code is either in the public domain or is copyrighted and distributed under an open-source license such as the Gnu General Public License (GPL). The license may require that the source code be distributed along with the software and that the source code be freely modifiable. Although it is commonly believed that any software which is available free of charge along with its source code is open source, this is neither entirely nor exclusively true. A wide variety of license types are available under the open source banner. It is possible for software to be distributed with its source code and still not be open source, and not all open source software must be free of charge.

Relevance for Teaching, Learning & Creative Expression

Open source software products may benefit the educational community by providing low-cost alternatives to commercial software applications with extensions that that can be shared. This "for the common good" dimension allows open-source tools to be extended to meet specific local needs without necessarily embarking on an expensive path of customization.

Examples

Sample open source development projects include Sakai (www.sakaiproject.org), Pachyderm (www.nmc.org/pachyderm/), and WebGUI (http://www.plainblack.com/webgui). See SourceForge (www.sourceforge.net) or IBM developerWorks (www-136.ibm.com/developerworks/opensource/).

The California Open Source Textbook Project (COSTP) seeks to leverage free, existing, widely-available K-12 educational content in the public domain, with a goal of removing the cost of purchased textbooks in California public schools (http://www.opensourcetext.org/).

Sample licenses:
- The Gnu GPL (General Public License): http://www.gnu.org/copyleft/gpl.html
- The Berkeley BSD License: http://www.opensource.org/licenses/bsd-license.php
- Creative Commons provides license texts for open content (and other types of content): www.creativecommons.org

For Further Reading

Open Source Initiative
This not-for-profit group has established basic guidelines for open source licenses and provides a certification service for open-source projects (www.opensource.org).

Wikipedia
Definitions of open source (http://en.wikipedia.org/wiki/Open_source) and open content (http://en.wikipedia.org/wiki/Open_content) give an excellent introduction to the topic.

The Cathedral and the Bazaar
This widely-read essay on open source has evoked strong reactions, both in support of and in opposition to the author's views.
http://www.catb.org/~esr/writings/cathedral-bazaar/cathedral-bazaar/

Time-to-Adoption: Two to Three Years

Affective Computing *(rename?)*

In most cases, interaction between humans is multimodal, which means we use a variety of senses during the give and take of conversation. We understand others' intentions, for instance, not just through words but also through gestures and expressions, and even the measured pace of breathing. Communication occurs on many levels and via many pathways.

When interacting with computers, however, we primarily communicate in a very rudimentary fashion, using approaches that have been largely unchanged for almost two decades. The most common way of interacting with computers today (labeled WIMP by some researchers — windows, icons, menus, and pointers) is an approach that depends highly on the visual sense. The human directs the computer by manipulating or reacting to changes on the computer screen, and through his or her input via the mouse and keyboard.

Affective interfaces take advantage of the capabilities of immersive environments to afford heightened multi-sensory learning experiences in discovery-based environments (e.g. manipulation of anatomy, geological exploration, remote camera or instrumentation control) or in collaborative situations (exploring a virtual or simulated space). This type of environment can also become an art object or performance experience.

Relevance for Teaching, Learning & Creative Expression
The potential of affective devices to greatly enhance the realism of simulations make these tools especially appropriate for designers of such experiences both in business and on college and university campuses. The potential applications could apply to virtually any discipline, but especially in disciplines in which realistic simulation environments can enable a suitable level of experience to be gained in a safe and reinforcing manner. In fields like medicine, which take unique advantage of haptic feedback in training medical professionals, affective interfaces have already achieved a critical mass of adopters.

Examples

The Gesture Recognition Homepage provides links to hundreds of related resources (www.cybernet.com/~ccohen/gesture.html).

Other examples: 3-d displays; R. Piccard – MIT Media Lab/affective computing; eye tracking; direction-giving kiosks that interpret and respond to pointing gestures.

For Further Reading

Can Machines Read Body Language?
Human communications depends heavily on nonverbal cues; that's often the best way to tell when someone is annoyed, or tired, or pleased. In contrast, it's often impossible to know from looking at it whether a robot is processing data, awaiting instruction, or in need of repair. Now, researchers from Switzerland and South Africa have designed a visual interface that would give autonomous machines the equivalent of body language.
http://www.technologyreview.com/articles/rnb_061804.asp?trk=nl

The Future of Faces
These days, all the hot-shot graphics folks are trying to figure out how to create realistic human faces with computer imagery. But photorealism can be pretty creepy.
http://www.technologyreview.com/blog/blog.asp?blogID=1444&trk=nl

Upbeat Computers Boost Users
Positive feedback from computers gives their users a lift, enabling people to perform better.
http://www.technologyreview.com/articles/rnb_051004.asp?trk=nl

Time-to-Adoption: Two to Three Years

Pervasive/Context-Aware Computing *(rename)*

Context-aware computing refers to computing devices that can interpret such contextual information and use it to aid decision-making and influence interactions. Contextual cues may include what the user is attending to, the user's location and orientation, the date and time of day, lighting conditions, other objects or people in the environment, accessible infrastructure in the immediate vicinity, and so forth. Context-aware devices and applications can make decisions based on such information without the need for user input.

Relevance for Teaching, Learning & Creative Expression
- Awareness of social settings
- Just-in-time information
- Highly personalized instruction

Examples

Projects in context-aware computing at the MIT Media Lab explore its possibilities (http://cac.media.mit.edu:8080/contextweb/jsp/projects.jsp).

AT&T Research Labs has deployed research prototypes of its Active Badge system, which pinpoints the location of employees wearing Active Badges (http://www.uk.research.att.com/ab.html).

Other examples: Geolocation, RFID, smart dust, cyberinfrastructure

For Further Reading

Geolocation Technology   Web-based geolocation technology can figure out where you are from your IP address--at least, most of the time. Blogger Simson Garfinkel worries that the widespread use of such technology will fundamentally change our idea of what the Web really means.
http://www.technologyreview.com/blog/blog.asp?blogID=1486&trk=nl

We like to watch   Ubiquitous sensors and massive interlinked databases are propelling us into the post-Orwellian era. Are we ready to know everything about each other?   Who will control the tools of surveillance and analysis: governments, corporations, John and Jane Q. Public, or all of the above?
http://www.spectrum.ieee.org/WEBONLY/publicfeature/jul04/0704over.html

Mike Villas's World   The technologies that define the Southern California dreamscape of "Synthetic Serendipity"—sensor networks, augmented-reality games, wearable computers, and silent messaging—are based on prototypes and products emerging from today's labs. The augmented-reality wonderland of Pyramid Hill and Fairmont High School is taking shape today.
http://www.spectrum.ieee.org/WEBONLY/publicfeature/jul04/0704mvw.html

Sensors & Sensibility It's alarming! It's no big deal! How your personal information is being collected and protected, used and misused. Costs, convenience, and security all converge on this: a world with more sensors, bigger databases, and much less privacy.
http://www.spectrum.ieee.org/WEBONLY/publicfeature/jul04/0704sens.html

Links:
Vocera http://www.vocera.com
Smart dust: http://www.computerworld.com/mobiletopics/mobile/story/0,10801,79572,00.html
Cyber infrastructure: http://www.acls.org/cyberinfrastructure/cyber_what_is.htm

Time-to-Adoption: Four to Five Years

Knowledge Webs

Knowledge web is a term that has seen a number of variations over recent years, but it is beginning to be applied to a group of convergent technologies and ideas based on a dynamic concept of individual and group knowledge generation and sharing, with technology used to make connections between knowledge elements clear, to distribute knowledge over multiple pathways, and to represent knowledge in ways that facilitate its use.

The emergence of a term to describe the concept is recognition of the convergence of work being done in digital libraries, mind mapping, communities of practice, and emerging technologies such as RDF, RSS, and data mining. Knowledge web development overlaps considerably with that going on around communities of practice, and holds considerable potential to help such communities share, create, analyze, validate, and distribute existing and emerging knowledge.

Relevance for Teaching, Learning & Creative Expression

The vision of a space where knowledge sharing tools, knowledge generation tools, dialog and discussion tools, and quality assurance approaches come together is a compelling one for educators of all levels, but especially for higher academe. The tools are developing rapidly, and in fields like the sciences, which must manage a torrent of new knowledge every day, considerable progress has been made in a number of areas. Many of the professional societies are already using advanced knowledge management tools, and supporting dynamic communities around that knowledge.

Knowledge webs are increasingly seen as a natural way for scientific and other disciplines to evolve the ways they apply technology to their traditional roles, and to help them both manage the flow of emerging knowledge, and make new findings and ideas easily and intuitively available to faculty and students. The design of these webs is likely to be very much tied to the way the disciplines already organize themselves.

Examples

- Semantic Web   www.semanticweb.org
- Unified Medical Language System   http://www.nlm.nih.gov/research/umls/
- Mindjet   http://www.mindjet.com/index.shtml
- Knowledge web of musical concepts
  http://trumpet.sdsu.edu/M345/knowledge_webs/knowledge_webs.html

Find examples that draw on cyberinfrastructure; remote sensing; space sensors; volcanic sensors; serendipitous discovery from mining real scientific data sets;

For Further Reading

CAS Science Spotlight
CAS provides a real-time, real-usage ranking of its most requested documents, articles and patents derived from millions of requests from scientists around the world. A document is characterized as "intriguing" if it contains new, novel or trendsetting scientific research that is likely to be of growing interest over time.
http://www.cas.org/spotlight/

The Educational Promise of Knowledge Webs and Virtual Communities
This article explores how knowledge webs help learners sift through the glut of information resources and make connections.
http://www.tie.smartlibrary.org/NewInterface/segment.cfm?segment=2244

Time-to-Adoption: Four to Five Years

Social Networking and Connection Tools *(rename)*

When expressed fully, this family of technologies will become "a means for substantive connections between people."

NOTES: Emphasis is on the social, not the tools or the collaboration. It's the social space, and it belongs to the learners, not to the faculty; maybe to the new faculty? Driven by students. Here for the students, far horizon for the faculty. Not sure what to do with it in class. Maybe not different from social networking; are they expressions of the same thing that have just not mainfested themselves in the same way yet? Eventually may converge. Music song list, matches you with people with similar interest. DodgeBall (www.dodgeball.com); Amazon recommendation models. Social networking may be more emergent, more important than the collaboration. High-touch? Focus on the spectrum of social networking and the emphasis of connections. Referral tools. P2P will likely be dynamic or an influencer on this.

Relevance for Teaching, Learning & Creative Expression

Wikis have been used successfully in classroom settings where students have created a "mini-encyclopedia" on a particular topic.

- Building learning communities; enabling connections between learners
- Interactions that are not limited by the boundaries of the classroom or class roster
- Means of finding and accessing expertise, knowledge, mentors

Examples

Flickr: an image exchange, but much more. Enabling things that individuals value and have social connections to.   http://www.flickr.com/

Wikipedia: an online encyclopedia featuring over 200,000 articles (in early 2004), is a living example of a wiki. http://www.wikipedia.org

Dodgeball: Tell us where you are, and we'll broadcast your location to all your friends and let you know if any friends-of-friends are within 10 blocks. http://www.dodgeball.com/social/index.php

For Further Reading

Group Dynamics Play Out in VR
Melding the characteristics of multi-user online games with those of computer simulations of large spaces yields a virtual environment that allows large numbers of people to interact.
http://www.technologyreview.com/articles/rnb_052004.asp?trk=nl

Messaging Tool Taps Social Nets
The "Small-World Instant Messaging system" could help suss out information that's too new to be part of an organizational knowledge base—or too valuable to be made public.
http://www.technologyreview.com/articles/04/07/rnb_071604.asp?trk=nl

"Reality Mining" the Organization
Who are the experts within your organization? Who has the most decision-making influence? Recently, managers have started mining data from e-mail, Web pages, and other digital media for clues that will help answer such questions. That's a start, but it misses the real action: studies of office interactions indicate that as much as 80 percent of work time is spent in spoken conversation, and that critical pieces of information are transmitted by word of mouth in a serendipitous fashion. Fortunately, the data infrastructure for mining real-world interactions is already in place.
http://www.technologyreview.com/articles/wo_pentland033104.asp?trk=nl

Time-to-Adoption: Four to Five Years

Gaming

"Games seem to have an enormous potential to teach just about anything in an engaging way. They're perfect for gaining deep understanding of cause-and-effect relationships. Even better, the information they impart has a tendency to stick with students, because they're interacting with it."

> (Dan Roy, from an online forum about gaming in education at The Education Arcade:
> http://www.educationarcade.org/index.php?name=PNphpBB2&file=viewtopic&t=13)

Computers and games go hand in hand, but games themselves are perhaps as old as humankind. Social or solitary, simple or complex, collaborative or competitive, games give us an opportunity to exercise the sense of play that makes us different from almost any other creatures. Children are able to learn games before they can talk (peek-a-boo!) and continue to expand their gaming repertoire as they get older.

Relevance for Teaching, Learning & Creative Expression

Even children are able to master the rules of very complex games quickly; just watch a group of eight-year-olds playing Magic: The Gathering. Provide an interesting premise, and students will learn the rules and play the game. Playing doesn't feel like working, so students may spend more time with a game than they would reading related material. The multidisciplinary nature of games lends itself to whole-curriculum programs, where knowledge is applied across many subjects. It is difficult to isolate a single skill or discipline in a game, and the interrelation of content can itself be very instructive.

Obviously, not all topics are suitable for adaptation to games. However, systems like physics, whose rules are simple even though there are many of them, are likely to be good choices. Material that has clearly defined levels of abstraction or specifically sequenced processes, like economics or biology, lends itself to games with levels or steps. Any subject matter that tells a story or allows students to experience the world as if they were someone else (history, literature, social sciences) could be adapted for role-playing.

Serious Games – people are looking at games in a disciplinary way, which is new; physicists are looking at games, maybe taking simulations to the next level (Charles Kerns). Social impact games (www.socialimpactgames.com). Like the "play" approach, but point out that the play aspect can also be an impediment.

Examples

Room 130: a collaborative project where students and faculty members at the University of Washington-Seattle on a book which will explore the nature of digital literacies as they emerge in and carry across authentic contexts of use.   http://labweb.education.wisc.edu/room130/

Games-to-Teach Project The goal of this project was to develop a vision of how games could be used to support learning, as well as to research the issues behind developing and marketing next-generational games (http://educationarcade.mit.edu/gtt/).

For Further Reading

The Education Arcade

An MIT research project called the Education Arcade aims to make computer and video games a valuable component of teaching: http://www.technologyreview.com/articles/atwood0604.asp?trk=nl

Scalpel, Sponge, Joy Stick…

Maybe there's something to all that hand-eye coordination stuff after all: a new study shows that video game players make the best surgeons.
http://www.technologyreview.com/blog/blog.asp?blogID=1357&trk=nl

Time-to-Adoption: Four to Five Years
Augmented Reality

"Augmented Reality (AR) is a growing area in virtual reality research. The world environment around us provides a wealth of information that is difficult to duplicate in a computer. This is evidenced by the worlds used in virtual environments. Either these worlds are very simplistic such as the environments created for immersive entertainment and games, or the system that can create a more realistic environment has a million dollar price tag such as flight simulators.

"An augmented reality system generates a composite view for the user. It is a combination of the real scene viewed by the user and a virtual scene generated by the computer that augments the scene with additional information. The augmentation can take on a number of different forms. In all those applications the augmented reality presented to the user enhances that person's performance in and perception of the world. The ultimate goal is to create a system such that the user can not tell the difference between the real world and the virtual augmentation of it. To the user of this ultimate system it would appear that he is looking at a single real scene."
> (J. Vallino, from his thesis at http://www.se.rit.edu/~jrv/research/ar/introduction.html)

Relevance for Teaching, Learning & Creative Expression
Augmented reality applications for education and the arts might include training scenarios, where users see techniques demonstrated even if the necessary equipment is unavailable, or a contextual data display showing historical information about buildings or botanical data about plants as the user approaches them. Performance art pieces might allow viewers to experience new landscapes, bizarre architectural spaces, or imaginary flora and fauna. The use of augmented reality to supply additional information in the context of what a user is actually seeing may be especially useful in areas like medicine, where a real-time ultrasound display of a patient's organs could be projected beside the patient for doctors and students.

Examples

Research and experimental development of a number of augmented reality projects, from entertainment systems to artworks to contextual data delivered using cell phones, is being conducted at the Bauhaus University (Weimar, Germany: http://www.uni-weimar.de/~bimber/research.php).

The Army's Objective Force Warrior program will offer unparalleled capabilities for the individual soldier. A company called Information in Place, Inc. is working with RDECOM to prototype an augmented reality training system which can be used to train soldiers to use these new tools (http://www.informationinplace.com/Solutions/CaseStudies/case_RDECOM/case_RDECOM.html).

For Further Reading

Augmented Reality: A New Way of Seeing
(Steven K. Feiner, in *Scientific American*, April 2002) This article presents augmented reality, with descriptions of technologies that are making it possible and examples for its applied use.
http://www.sciam.com/article.cfm?articleID=0006378C-CDE1-1CC6-B4A8809EC588EEDF

A Survey of Augmented Reality
(Ronald T. Azuma in *Presence: Teleoperators and Virtual Environments 6*, 4 (August 1997)) This paper surveys the field of Augmented Reality, describing the medical, manufacturing, visualization, path planning, entertainment and military applications that have been explored.
http://www.cs.unc.edu/~azuma/ARpresence.pdf