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NMC Horizon Project

2005 Idea List

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Time-to-Adoption: One Year or Less

Enterprise Tools for Learning

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.

For example, at California State University Hayward, faculty and students find Blackboard accounts ready and waiting for them at the start of each semester. An online component for each course has been prepared, and registered students pre-enrolled, by the campus information technology staff. Training is readily available for faculty, and IT staff are committed to providing prompt support. As a result, more courses on campus use a Blackboard component than otherwise would.

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

Examples

- Portals (*myU at University of Minnesota, MPortal, UCSD*)
- Repositories (*MIT, OSU, Calgary, Fedora*)
- Course management systems (*Blackboard, Web CT, Sakai*)

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:

- 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.

Examples

Freely available wireless access is currently being deployed in these and other locations:

- Universities like Dartmouth and the University of British Columbia
- Bradley International Airport, Hartford, CT
- The town of East Haddam, CT

For Further Reading

Wi-Fi Goes to Town

(In *Technology Review*) Add Wi-Fi access to garbage collection and police protection as services that many municipalities now regard as essential amenities for citizens (login required to view article).

<http://www.technologyreview.com/articles/innovation40704.asp?trk=nl>

WWiSE Words on 802.11n

(Eric Griffith, in *Wireless*: August 12, 2004) The WWiSE consortium have decided to unveil the specifics of what they hope will be the next standard.

<http://www.internetnews.com/wireless/article.php/3394291>

Other Links

- <http://www.pcmag.com/article2/0,1759,1635778,00.asp>
- <http://www.intel.com/netcomms/technologies/wimax/index.htm>
- <http://www.wimaxforum.org/home>

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>

Time-to-Adoption: One Year or Less

Learning Applications for Common Tools

Tools like 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 may begin to find ways to 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/>

For Further Reading

Web-Based Manipulatives

These websites, which serve as interfaces for the control of devices (or simulations of devices), allow students to conduct live experiments without needing to be physically present with the device, enabling institutions to share expensive devices. Students have the opportunity to work with real materials, when and where it is appropriate or convenient. Examples include:

- iLab: Remote Online Laboratories (MIT): <http://icampus.mit.edu/projects/iLab.shtml>
- IN-VSEE, remote operation of microscopes and nano-fabrication tools: <http://invsee.asu.edu/>
- *Innovation* article about the remotely-controlled Nomad robot rover, which explored 133 miles in Chile's Atacama Desert: <http://nctn.hq.nasa.gov/innovation/Innovation55/paves.htm>

Electronic Portfolios/Personal Learning Portfolios

Proponents of portfolios describe them as offering rich possibilities for learning and assessment. With increased pressure for better understanding of college and university students' learning, and external pressure for better representation of it, portfolios offer an approach that can demonstrate learning over a period of time. For years, AAHE has been engaged in the work of creating portfolios as alternative means of assessment with its work around teaching and course portfolios. This site provides information about the newest version of this work, the electronic portfolio.

<http://aahe.ital.utexas.edu/electronicportfolios/>

^{*} 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 RSS⁷ 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.

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:

- Cartoonbank.com (<http://www.cartoonbank.com>)
- Getty Images (<http://www.getty.edu/>)
- The Open Video Project (http://www.open-video.org/project_info.php)
- Boeing Image Gallery (<http://www.boeing.com/companyoffices/gallery/>)
- MIT's Digital Repository, Dspace (<https://dspace.mit.edu>)

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

Desktop Dashboard

(In *Technology Review*) A free program called Dashboard constantly combs through your e-mail, calendar, address book, word-processing, and browser programs and brings together information related to your current tasks—before you even know you want it (login required to view article).

<http://www.technologyreview.com/articles/prototype30704.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

⁷ RDF [Resource Description Framework] Site Summary

Time-to-Adoption: Two to Three Years

Open Source

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.

One premise of the open source movement is simply that software will evolve if programmers can read, modify, and redistribute source code. Open-source software is improved, adapted, and fixed at a speed that conventional software development often cannot match.

Relevance for Teaching, Learning & Creative Expression

Open source software products may benefit the educational community by providing low-cost alternatives to commercial software applications. *Open source content*, *open content*, and *share-alike* are terms for creative works like text, images, audio, and video that are published in a format that explicitly allows the copying of the information. This type of material has obvious potential for educational and creative use.

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

Multimodal Computing

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.

Multimodal 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 multimodal 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, multimodal 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).

For Further Reading

Cursor Speed Shows Virtual Bumps

An interface that matches cursor speed to on-screen textures lets users feel surfaces by sight. http://www.technologyreview.com/articles/rnb_060304.asp?trk=nl

Adaptive technologies specialized for learning

Adaptive technologies are now being viewed as potentially useful for people with learning disabilities, or who simply prefer one learning style over another. University of Toronto's Adaptive Technology Resource Centre provides a free online introductory course and other resources. <http://www.utoronto.ca/atrc/reference/tech/techgloss.html>

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>

Time-to-Adoption: Two to Three Years

Pervasive or Context-Aware Computing

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>).

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>

The Digital Apartment There have been plenty of "smart house" demos. But at Placelab, researchers are studying how people really interact with their homes—the better to design truly useful residential technologies.

<http://www.technologyreview.com/articles/innovation40604.asp?trk=nl>

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

The Semantic Web is a special kind of knowledge web. The idea is that tools could be constructed by finding and linking to components housed all over the web (www.semanticweb.org).

The National Library of Medicine's Unified Medical Language System is a knowledge web for medical terminology, offering several tools (<http://www.nlm.nih.gov/research/umls/>).

Mindjet is a company that creates information visualization products for managing personal or organizational knowledge webs (<http://www.mindjet.com/index.shtml>).

An incredible knowledge web of musical concepts that starts with a plain-text interface but soon becomes a clickable concept map that invites exploration is part of a music course at San Diego State University (http://trumpet.sdsu.edu/M345/knowledge_webs/knowledge_webs.html).

For Further Reading

James Burke's KnowledgeWeb Project

"The knowledge web today is an activity rather than a web site—an expedition in time, space, and technology to map the interior landscape of human thought and experience."
<http://www.k-web.org/index.html>

Time-to-Adoption: Four to Five Years

Social Collaboration Tools

Social collaboration tools use technology as a mediator of social interaction and collaboration, and could have significant application for teaching and learning, especially at a distance. What makes these tools interesting as an approach is that the technology-enabled interactions are generally founded on a set of intuitive strategies that foster high-quality and efficient communication. A variety of simple but easily accessible tools make these interactions possible over a wide variety of modalities. The result is more effective knowledge generation, knowledge sharing, collaboration, learning, and collective decision-making, and is especially applicable to distributed learning, research, and work settings.

Social collaboration tools provide a "workspace," usually accessible over the internet, where a group of people can interact synchronously and/or asynchronously, contribute work, and see and react to the work of others. Some common examples include wikis (collaboratively created and maintained websites), online meeting software like Macromedia Breeze and iCohere, and course management software (Sakai, Blackboard, WebCT), though there are many others.

Note that social collaboration is not the same as social networking. Systems like Friendster or SixDegrees that keep track of relationships generally do not (yet) directly support collaboration.

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. Course management tools like Blackboard and WebCT are commonly found on university and college campuses. As these and other tools continue to be developed and experimented with, their use will spread. Models like MERLOT's Peer Review workspace may become more commonplace as distributed teams seek more convenient ways to work together.

Examples

The Collaborative Learning Environments Sourcebook contains an introductory piece on wikis, with links to interesting wiki projects (http://www.criticalmethods.org/collab/v.mv?d=1_34) – don't miss the links on the right to other collaborative learning topics (communities of practice, collaboration roles, and others).

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

iCohere has created a complete system that can be used to hold conferences entirely online (www.icohere.com).

For Further Reading

Interface Blends Screen and Video

An experimental videoconferencing system superimposes transparent images of a computer's desktop over video images of the user--potentially valuable for remote teaching, PowerPoint presentations, and as a collaborative PC interface.

http://www.technologyreview.com/articles/rnb_070204.asp?trk=nl

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

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.

Examples

Members of Room 130 are currently collaborating with 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. Individual chapters will consist of empirical investigations and theoretical accounts from a variety of disciplines and will seek to blur the artificial boundaries between online and offline contexts of use (<http://labweb.education.wisc.edu/room130/>).

In its first year, the Games-to-Teach Project designed a set of 10 conceptual frameworks of educational games in math, science, engineering, social science, and humanities. The goal of this exercise 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>