NMC Horizon Project
2006 Short List

Contents

Time-to-Adoption: One Year or Less

Social Computing

The idea of social computing is not new to the *Horizon Report*; it has been on the horizon and moving closer over the past few years. Already in common use outside of the educational arena, social computing practices are cropping up on campuses with increasing frequency. The promise of social computing has been—and continues to be—more effective knowledge generation, knowledge sharing, collaboration, learning, and collective decision-making. This promise is beginning to be realized in the areas of distributed learning, research, and campus work settings.

Social computing itself is essentially the application of computer technology to facilitate collaboration and working in groups. The strategies and tools used in social computing enable rich, efficient communication at a distance, synchronously or asynchronously, opening up new possibilities for working together. The tools themselves are not the focus; the interactions supported by those tools are what is most interesting. The tools are influencing the trend, however. As social computing tools become increasingly easier to obtain and use, and as more and more people adopt them, social computing interactions are transferring from the world at large into the world of education. Students, already familiar with tools for working together and sharing knowledge and information (think of Flickr, an online community for sharing photographs; instant messenger, for getting quick answers to questions and arranging get-togethers; Skype, for inexpensive voice-over-IP conversations in realtime), are bringing these tools to campus and continuing to integrate them into their pattern of daily life and work.

Relevance for Teaching, Learning & Creative Expression

- allows faculty to engage in on-line discussions about pedagogical or research issues
- facilitates collaborative writing and research among students
- extends the discussion outside of the space and time of the physical classroom
- opens opportunities for creative presentation of research materials or points of debate

Examples

- A Swarthmore faculty posts his syllabus and receives comments and suggestions from peers: http://weblogs.swarthmore.edu/burke/?p=87
- Radford University's Technology and Learning Center hosts a technology blog for faculty: https://php.radford.edu/~tlc/wordpress/
- Two faculty who used IM for office hours assess its success and utility in an online journal: http://www.firstmonday.org/issues/issue10_11/roper/
- Wikipedia, the online, editable encyclopedia: http://www.wikipedia.org

For Further Reading

RSS Feeds College Students' Diet for Research
(Anh Ly, *USA Today*, August 1, 2005.) Discusses how RSS is becoming more popular among college students to obtain research information from the web.
http://www.usatoday.com/tech/news/2005-08-01-rss-research_x.htm

Wiki Pedagogy
English and French versions available. Extensive on-line article by Renee Fountain describing wikis and laying out their pedagogical aspects.
http://www.profetic.org:16080/dossiers/dossier_imprimer.php3?id_rubrique=110

Time-to-Adoption: One Year or Less

Personal Video/Audio Sharing

Already common among consumers, the sharing of informally produced personal audio and video content is rapidly moving into academia as a form of personal expression and as a means of information delivery. The basic concept of sharing personal experiences that began with text as the medium (personal websites and blogs, for instance) is extending into other media as the tools to capture and create audio and video are maturing.

Recording devices for both audio and video are small, portable and relatively inexpensive, the quality of captured media is high, and the process of publishing video and audio is becoming easier and easier. Already it is possible to drop a video clip onto a web page, trim it, and upload it in minutes (see VideoEgg, www.videoegg.com, for one example; there are others). The clip can be embedded in any web page with a few lines of provided code. Audio is equally easy to share: a podcast can be quickly published to the iTunes music store, for example, where it is easily retrieved.

The most interesting possibilities introduced by this trend center around the sharing aspect. Social networking tools which cater to a specific community and allow users to generate and share content are increasingly popular; consider Facebook, which is aimed specifically at high school and college students. As a place where students can connect with agemates in their own geographical area, Facebook became incredibly popular almost overnight. This trend is expanding as social networking tools incorporate video and audio. Imagine how it will take off when cell phones can capture high-quality audio and video: everything you need, in one device you already carry.

Relevance for Teaching, Learning & Creative Expression

- enhances learning in oral and auditory fields (foreign languages, speech pathology)
- encourages creative synthesis of audio or video resources from a variety of sources

Examples

Drama faculty at the North Carolina School for the Arts are using iPods to record accent and dialogue for students to study. A faculty member from design and production uses iPods for several things, including creation of weekly "listening lists."

A Women's Studies Course at California State University, Fullerton includes an assignment for students to "sign up for one of the following development teams: vblogging [video blogging], blogging, podcasting, class website, video, cell net. Each team will be responsible for developing a project that uses one of these technologies as an intervention into gender inequality."

For Further Reading

Publishing a Podcast to iTunes
A single page of instructions on distributing podcasts and other recorded media via iTunes, using RSS.
http://phobos.apple.com/static/iTunesRSS.html

Vlog Map
How many video blogs are there in the world? Well, this map will give you an idea. Click a pin on the map to view a blog and find out who keeps it and where they live.
http://www.vlogmap.org/

SixApart Simplifies Video Blogging
(Shelly Solheim, *eWeek*, October 26, 2005) One blog service provider makes it easy to add video.
http://www.eweek.com/article2/0,1895,1877776,00.asp

Time-to-Adoption: One Year or Less

Advanced Video Collaboration & Communication

The convergence of high definition video and broadband is changing the way we think about video and video conferencing. The tiny talking head in one corner of your monitor is no longer the state of the art; video communication now involves large-format multimedia displays that almost seem to bring the participants right into the same room, wherever they may be. Access Grid, a collection of resources and technologies that enable this kind of interaction, is a compelling model: there are thousands of certified sites, or nodes, equipped to connect with one another all over the world. A key difference between old-style video conferencing and advanced communication is the number of participants; Access Grid is designed to support large-scale, group-to-group interactions and collaborative work, while traditional videoconferencing linked, at best, a few individuals.

The underlying technologies that support this advancement are high-definition video and high-speed Internet or broadband. As these technologies improve, the possibilities for groupwork at a distance expand. In the world of industry, events like the merger between Cisco and Scientific Atlanta support the convergence of these technologies and the development of advanced collaboration systems.

Relevance for Teaching, Learning & Creative Expression

- opens the classroom to remote students, faculty, and domain experts
- enables demonstration and experience of mechanical or laboratory techniques
- allows groupware and visualization software to be used collaboratively among participants
- encourages collaborative research, discussion, and problem solving

Examples

The Centre for Microscopy and Microanalysis at The University of Queensland offers live and interactive electron microscopy and microanalysis sessions for remote researchers, industry representatives, lecturers, students and other interested groups on the Access Grid.
http://www.uq.edu.au/nanoworld/agrid.html

Boston University has used Access Grid technology to interview potential graduate students in China:
http://www.bu.edu/bridge/archive/2003/03-28/virtual.html

At the University of Alberta, faculty and staff who are unable to travel can attend conferences like SuperComputing 2005 via remote video conference:
http://www.ualberta.ca/CNS/RESEARCH/AccessGrid/

For Further Reading

Transforming Pedagogy Through Conversion to Digital Video Methods: A Practical Example in A University Setting
(by Larry Gilbert, undated.) A short paper written by the Director of Academic Technology at Western Washington University, which provides an overview of digital video collaboration.
http://west.wwu.edu/atus/director/icem_geneva.asp

AccessGrid.org
The Access Grid website contains information about how to set up Access Grid technology, links to community discussions, and a listing of existing nodes around the world.
http://www.accessgrid.org/

Time-to-Adoption: One Year or Less

Portable Devices

This is the leading edge of a wave that will last for the next several years and beyond. The increasing presence of ever more capable devices among students, such as today's iPods, has already spurred the creation of podcast content expressly for that platform. The promise of portable devices is that they are small and students already own and carry them; the challenge is to deliver content and services to those devices, when they are popular, whatever they are.

Taking the iPod phenomenon as an example, it seems obvious in retrospect why it has become so widespread. Young people were the target of very sophisticated marketing campaigns that assured the popularity of the iPod; almost overnight, it seemed that nearly everyone had one. The appeal of the device itself was increased by its size (tiny) and weight (light). Utterly portable, popular, and cute, the iPod is also incredibly easy to use: adding musical content is a snap. The brilliant stroke here was to take advantage of this ready-made, widely available tool and deliver *educational* content for it as well.

Many students who own laptops do not carry them to class, because they are bulky and heavy and uncool. Small devices like the iPod, however, go wherever the student goes. Since students buy them anyway, universities do not incur the expense of providing the equipment. Even the content delivery mechanism has been provided for: any mp3 file can be downloaded and copied onto the device.

The portable device trend is only beginning. As soon as other devices commonly carried by students (think digital phones) have similar capabilities, and as soon as we figure out how to get content onto them, this trend will really take off.

Relevance for Teaching, Learning & Creative Expression

- opens up possibilities for access to content (lectures, commentary, foreign language tools; eventually images, video…)
- takes advantage of devices students already own and use

Examples

Edupodder.com is a website founded and maintained by an academic technologist at San Jose State University. The site includes resources, examples and a blog about the medium of podcasting.
http://www.edupodder.com/

Databases are being developed to maintain information that can be downloaded to mobile phone users. One such database, BioWAP, allows the mobile user to search nucleotide and protein sequence databases, along with other types of biological data.
http://bioinf.uta.fi/courses/WappaW/BioWAP.html

For Further Reading

Professor in Your Pocket
(Peg Tyre, *Newsweek*, November 28, 2005.) Discusses how students and faculty are using and seeing lecture podcasts, and some of the issues that arise.
http://www.msnbc.msn.com/id/10117475/site/newsweek/

Wikipedia: Podcasting
The Wikipedia offers an extensive article on the history and current state of podcasting, including links to examples, tutorials, and discussion about the topic.
http://en.wikipedia.org/wiki/Podcasting

Time-to-Adoption: Two to Three Years

Ubiquitous Networks

Now that networks are essentially everywhere (and broadband over power lines and Wi-Max will take it the rest of the way), exciting applications are unfolding that include presence-awareness, grid computing, and mesh networks. Presence-awareness will make it possible to deliver tailored information or services based on a user's actual physical location or state of attention. Grid computing involves shared data storage and increased power, enabling networked personal computers to combine speed, memory, and storage to perform operations that they could not perform on their own; essentially, it is large-scale distributed computing. One example of a technology which uses grid computing is e-Science, which collects and stores data from many different sources, such as satellites, lasers, and telescopes. Mesh networks are decentralized ad-hoc networks which can include wireless devices and can be either static or kinetic. Worldwide grid computing is still in the future, but limited grids are already being used on a small scale. As more and more devices such as mobile phones are configured to obtain access to the Internet and to transmit data to each other, spontaneous mesh networks are appearing.

Relevance for Teaching, Learning & Creative Expression

- increases the potential for collaboration in research and teaching
- increases access to data and teaching material
- allows for expanded types of student-teacher and student-student interaction, in various places and by various means
- increases the capacity for information storage and retrieval

Examples

The Cambridge University e-Science Center has a Molecular Informatics project in which robots "read normal journal articles and extract the molecular data, which is turned into XML, aggregated, and validated in CML (Chemical Markup Language)." The data is then represented in a generic architecture. This is part of a United Kingdom initiative for grid computing and e-science.
http://www.escience.cam.ac.uk/projects/mi/ and http://www.rcuk.ac.uk/escience/

Numerous institutions are already working toward grid computing or mesh networks on both technological and pedagogical fronts. Syracuse University estimates that grid computing will be available to its faculty by 2007: "By 2007, advances in network capacity and GRID-computing will give researchers vastly greater computing power and speed. GRID computing and the wider adoption of open systems will allow faculty to solve problems that require massive computing and manipulation of huge data sets. Real-time distant collaborations will be commonplace, and the vision of a worldwide community of scholars will continue to advance as a reality."
http://cms.syr.edu/projects/complan/final/plan4.cfm.

For Further Reading

The Future of Networking in Higher Education
(Richard N. Katz, *EDUCAUSE Review,* vol. 40, no. 4 (July/August 2005): 62–75.) Discusses the history of networking and describes the trends, issues, and implications of integrated cyberinfrastructure in education. http://www.educause.edu/apps/er/erm05/erm0547.asp

A New Outlet for Broadband
(Eric Hellweg, *Technology Review*, July 18, 2005.) This article discusses broadband internet access becoming available over electrical power lines.
http://www.technologyreview.com/InfoTech/wtr_14622,258,p1.html

Time-to-Adoption: Two to Three Years

Enterprise and Web Services

Enterprise systems are already widely used in academia for administrative purposes, and will soon move to a service-based model that can be used between campuses and in the classroom. The next generation of enterprise and web services will include net documents, web applications, and place-based services designed to answer the needs of increasingly mobile users, who will want easy access to media, research, and work documents wherever they (the users *or* the documents) happen to be.

Key areas of development have thus far been in course management systems, portals, and library applications. New directions may include networked-based systems like portfolios, collaborative working environments, media authoring tools, and tools to manage social contacts and interactions. Shared writing environments like WriteBoard, Writely, and SyncroEdit are beginning to be adopted by those on the leading edge of academic technology. Web-based project planning and organizational tools like Basecamp or BackPack, which are just beginning to emerge, will grow in popularity and become more widespread. In medical, legal, and research fields, online document management services are already in use; before long, services like these will likely find their way into education.

Relevance for Teaching, Learning & Creative Expression

- simplifies complex systems, making them more likely to be adopted and used
- facilitates bringing information from faculty research to courses or on-line discussion groups
- allows access to documents, information, and work-in-progress from any computer with an Internet connection
- encourages collaboration on individual, group, and institutional levels

Examples

The Stellar Course Management System at MIT provides website updating, class rosters, and RSS feeds; coordinates academic calendars with class schedules; and even offers copyright information, among other features. http://stellar.mit.edu/

The University of Toronto Library is taking part in a collaborative effort among eleven research libraries to maintain a Jewish history web portal. Librarians are able to keep the information up to date and not duplicate each other's work though this collaboration.
http://www.ala.org/ala/acrl/acrlissues/effectiveprac/acrleffectivepracticesuniversitytoronto.htm

Pachyderm, a web-based multimedia authoring tool, allows non-technical authors to create compelling learning objects using web browsers. http://www.pachyderm.org

For Further Reading

Convergence
(Campus Technology, December 2005) Part of a list of 101 best practices in educational technology, this set of case studies and examples demonstrates various ways that campus services are converging.
http://www.campus-technology.com/article.asp?id=17564

Is It Time to Start Sharing the Course Management System?
(Frank Tansey, in *Campus Technology*, April 2005) Discusses the value of sharing the CMS between instructional and administrative departments on campus.
http://www.campus-technology.com/article.asp?id=10896

Time-to-Adoption: Two to Three Years

Smart Phones

Cell phones have already begun to feature many capabilities that initially were associated with other devices, such as e-mail, instant messaging, web browsing, and even video. A recent survey of cell phone users in 21 countries indicated that over half are using them for Internet or e-mail services compared to a little over a third in 2004. As the next crest in the wave of portable devices, smart cell phones are poised to break over academia with the force of a tsunami. In other parts of the world, where people commonly own multiple cell phones, they are already moving into the classroom.

In one increasingly common use of these devices, physicians are using their smart phones to access patient clinical data; it is easy to imagine a similar application for any course requiring significant amounts of stored data. Another new application is that created by ComVu, which allows video enabled smart phones to broadcast video to another smart phone device or to a computer. A smart phone is essentially a computer, and software that is developed for it will bring many of the same capabilities of a PC or laptop to this much smaller, more portable device.

Relevance for Teaching, Learning & Creative Expression

One advantage is enhanced collaboration: increased video mobility allows for better on-the-spot feedback, as for example a difficult bird or plant identification. Since a phone is more portable than a laptop, access to data while in the field could also be increased. Cell phones can be used as access points to information stored on the web. Short text messages could be used as a means of testing or assessing learning, either by the teacher or as a self-assessment method with other students. Cell phones which incorporate GPS devices can be used in many disciplines and areas where location-specific information is needed. Smart phones could be used for their original purpose—voice communication—and, with their other capabilities, become sophisticated conferencing or lecturing tools.

Examples

Stephen Cheung of the University of Sydney used SMS messaging to conduct classroom experiments in economics, including the bargaining game and the contributions game. This replaced the inefficient paper and pencil; it is worth noting that a full computer simulation of these games was not a practical option, but moving it to text messaging on cell phones was.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=605863

At Coventry University in England, students in the New Media Studies Program are using smart phones to download videos and to receive their grades.
http://westmidlands.ideasfactory.com/new_media/features/feature51.htm

For Further Reading

What Can You Learn from a Cell Phone? Almost Anything!
(Marc Prensky, 2004) Discusses various uses of cell phones in classrooms.
http://www.marcprensky.com/writing/Prensky-What_Can_You_Learn_From_a_Cell_Phone-FINAL.pdf

Cell Phones: Nuisance or Necessity?
(Elizabeth Melville, *Teaching Today*, January 2005) Presents pros and cons of allowing cell phones in classrooms, and suggests some possible educational uses for phones.
http://www.glencoe.com/sec/teachingtoday/educationupclose.phtml/52

Time-to-Adoption: Two to Three Years

Digital Gaming

Gaming, particularly in the form of simulations and role playing, has been a part of education for years. In its digital forms, games can include immersive experiences that explore culture, synthetic worlds, or micro-landscapes, or that build upon years of experience in using visualization as a tool for the exploration of large data sets. Gaming can be used in disciplines outside of computer, technology, or new media studies; designing games can also incorporate other aspects of social or cultural studies into technology fields. Gaming is also being used as a way to increase enrollment and retention rates in computer programming and science fields.

Digital gaming can take the form of using computers or other digital devices in place of mechanical or material components in traditional games, or can engage in its own world-building. Gaming itself is a sort of lowest common denominator of human interactivity; everyone has played games. Just as children use games to learn skills for adulthood, gaming can be incorporated into education as a platform for knowledge-based learning. Games do not need to be framed as win/lose scenarios but can be exploratory and collaborative.

Relevance for Teaching, Learning & Creative Expression

- can be used to teach concepts across multiple fields in an engaging way
- allows re-enactment of difficult situations to try new responses or pose creative solutions
- enhances visual learning and develops technological skills
- can be done in groups, encouraging collaboration and interaction

Examples

Michigan State University's Digital Media Arts and Technology has a project funded by the National Science Foundation called Girls as Game Designers, which does research on how girls and boys approach games, and how games affect them. One of the projects that has grown out of the Girls as Game Designers research is Alien Games, which is designed to interest high school and middle school girls in biology and space science. http://spacepioneers.msu.edu/

The University of California at Berkeley offered an anthropology field work course in fall 2005 emphasizing digital storytelling as a way to express material culture. In the course, students "bring the archaeological experience to 6th graders through facilitated play with a variety of media, including: digital storytelling (video production), computer games, web browsing, hands-on exploration of real artifacts, etc." http://anthropology.berkeley.edu/courses.html

For Further Reading

Play and Learn
(David Stonehouse, *The Age*, August 27, 2005.) Outlines the educational possibilities for gaming, raises pertinent questions, and gives an overview of the academic movement toward digital gaming.
http://theage.com.au/articles/2005/08/23/1124562860174.html

Proof of Learning: Assessment in Serious Games
(Sande Chen and David Michael, *Gamasutra*, October 19, 2005.) Discusses the challenges and issues of assessing game-based learning. http://www.gamasutra.com/features/20051019/chen_01.shtml

Designing Courses: Digital Games for Learning
This website includes a detailed annotated bibliography with links to game-related articles. http://www.ibritt.com/resources/dc_games.htm

Time-to-Adoption: Four to Five Years

Augmented Reality and Enhanced Visualization

Well underway in disciplines like medicine, engineering, the sciences, and archaeology, augmented reality and enhanced visualization techniques offer dramatic new ways for humans to use visual comprehension skills to explore complex phenomena, situations and relationships. By combining richer, three-dimensional imagery with contextual information, augmented reality allows viewers to assimilate different types of information about a single topic at the same time. Augmented reality is also being combined with games to enhance the learning experience of the games; this combination will likely broaden the application of this technology to fields such as the humanities where it has not yet made significant inroads.

Enhanced visualization facilitates the transfer of knowledge from one person to another by incorporating various means of representing, understanding, and experiencing that knowledge. Complementary forms of representation, including contextual information, animations, drawings, sounds, and other forms that contain more than just factual information, are used to convey a broader sense of the concept.

Relevance for Teaching, Learning & Creative Expression

- provides a superior model of an object (heart, mechanical device, etc.)
- allows information to be "projected" onto an object so that users don't need to turn their attention away to look things up
- encourages collaborative learning by offering a virtual "product" for learners to interact with
- can create a body memory of a subject, which encourages retention of knowledge

Examples

- MIT's "Teacher Education Program" is using augmented reality on handheld devices in simulated games, including an environmental spill simulation and a "whodunit" at an art museum. http://education.mit.edu/ar/

- The "Envision Center" at Purdue University is focused on research and design in computer-based visualization, including creating a platform-independent haptic rendering system. http://www.envision.purdue.edu/

- The University of Florida has developed a transparent reality simulation engine which can be applied to a variety of disciplines, including nursing, chemistry, and physics. The engine "represents internal, abstract and usually invisible functions, processes and concepts with explicitly visible and manipulatable symbols to assist users in exploring, developing and confirming mental models." http://vam.anest.ufl.edu/wip.html

For Further Reading

Trend: Augmented Reality Check
(Eva Kaplan-Leiserson, *Learning Circuits*, December 2004.) This article summarizes different types of augmented reality and examines their applications in education. Includes links to other useful articles.
http://www.learningcircuits.org/2004/dec2004/0412_trends.htm

Augmented Reality Brings Maps to Life
(Will Knight, *New Scientist*, 19 July 2005.) Paper maps can be brought to life using hardware that adds up-to-the-minute information, photography and even video footage.
http://www.newscientist.com/article.ns?id=dn7695

Time-to-Adoption: Four to Five Years

Next-Generation Folksonomic Tools

Just as tools like *Flickr*, *Facebook*, *del.icio.us* and others have replaced taxonomies and ontologies in social networking contexts, next generation folksonomic tools will allow researchers to dynamically create coding and classification schema that reflect the collective wisdom of their community. College websites incorporating such tools would use tags created by users to enable sophisticated non-linear browsing, searching, and finding based on user perceptions and needs. Tagging by members of a specific learning community such as students in a particular course could lead to a course-specific language, or a kind of shorthand for complex topics, that would enrich discussion and increase a feeling of community instead of isolated learning.

As the amount of material available on the Internet expands, it is increasingly valuable to be able to quickly determine the relative value of any particular piece of information or media. One way to do this is to review the opinions of trusted friends and colleagues; folksonomic tools make this possible. By tagging the good and ignoring the bad, the community makes it easier to find useful material. This process has obvious application to teaching, learning, and research, as well as to creative expression (consider remix culture: the easier it is to find something, the easier it is to use it).

Relevance for Teaching, Learning & Creative Expression

- makes information more intuitively retrievable
- makes use of community knowledge
- raises questions about classification and identification that encourage both analytical thinking and wider ontological questioning, through the act of tagging a complex subject
- facilitates creation of knowledge webs and sharing of information

Examples

The Art Museum Community Cataloging Project seeks to resolve the disparity between museum professionals' tagging terms and those of museum visitors—which rarely match—by encouraging public tagging of museum collections, online.
http://www.steve.museum/

A teacher's blog suggested that folksonomic tagging would be useful in storing old lesson plans and other classroom " binder" materials that school districts don't have the resources to otherwise archive.
http://www.edugadget.com/2005/02/01/the-long-tail-of-education/

For Further Reading

Communal Categorization: The Folksonomy
(David Sturtz, December 16, 2004) Provides a general overview of folksonomy.
http://www.davidsturtz.com/drexel/622/sturtz-folksonomy.pdf

Folksonomies: Power to the People
(Emanuele Quintarelli, June 24, 2005) This paper discusses the history and current manifestations of folksonomies.
http://www.iskoi.org/doc/folksonomies.htm

Folksonomy for Applied Analysis and Market Action
(The Community Engine Blog, February 23, 2005) Overview of folksonomy, cultural issues regarding tagging, and how tagging can be used to target a specific group.
http://thecommunityengine.com/home/archives/2005/02/folksonomy_for.html

Time-to-Adoption: Four to Five Years

Context-Aware Computing

It is now practical to produce computers that can make decisions based on contextual clues, such as what the user is attending to, the user's location and orientation, what the user is focused on, the date and time of day, lighting conditions, other objects or people in the environment, accessible infrastructure in the immediate vicinity, and so forth. The implications are only beginning to be explored, but may be profound. Context-aware computers can interact with the user or can program themselves to have particular responses appropriate to a situation; for example, to lower the volume of music being played when a telephone rings nearby, or to silence all calls during a meeting or class.

Although the educational application of context-aware computing is still several years away, early experiments continue to spark ideas about how this group of technologies may be applied. Some universities have employed GPS-capable handheld devices for campus tours, giving the viewer information about whatever building or monument happens to be nearest. Applications for context-aware computing will increase as the technologies that make it possible become integrated with commonly carried portable devices, such as cell phones.

Relevance for Teaching, Learning & Creative Expression

- allow tailored presentation experiences; for instance, automatic adjustment of lighting, sound, and projector brightness as faculty moves through a lecture (brighter lights on the faculty when s/he steps away from the screen, or brighter projection when his/her attention returns to it)
- identify the teacher and enable him/her to control projection, lighting, and other room features from anywhere in the room
- deliver information relevant to the learner's location (in a library, museum, or other physical space)

Examples

Tsinghua University has developed a smart classroom that incorporates pervasive computing technologies to sense where learners are in the physical space, what they are doing, and what they may need. The lecturer controls the display with voice and gesture.
http://media.cs.tsinghua.edu.cn/~pervasive/projects/classroom/

The context-aware cell phone project at MIT is attempting to build a wearable cell phone which will receive signals about the user's location and behave appropriately (turn themselves off, for example). In a prior MIT project, researchers developed a phone that acquired data about whom the user knows , where the user goes, and what the user habitually does, and then can give the user feedback based on the information it collects.
http://www.eurekalert.org/pub_releases/2004-11/ns-tpt112404.php

For Further Reading

Context-Aware Computing: A World That Knows What to Do for You
(Paul Brand, Stanford HCI Seminar, May 2005) In this webcast of a seminar from Stanford University, Paul Brand discusses several context-aware computing projects from around the world.
http://www.usabilityviews.com/uv010028.html

Potentials and Challenges of Context Awareness for Learning Systems
(Andreas Schmidt, undated.) This paper discusses the challenges of a context aware e-learning system, which would ideally know what material to deliver when to the student.
http://www.andreas-p-schmidt.de/publications/abis05_aschmidt.pdf

Time-to-Adoption: Four to Five Years

Even Smarter Classrooms

Remote sensing and control technologies, delivered over the ever-present network, will enable real-time access to laboratories, sophisticated equipment, and experiments directly from the classroom. Advanced video conferencing and collaboration tools combined with real-time language translation tools will allow the creation of global learning communities. Real-time recording and indexing tools will allow lectures to be captured and made searchable in a single pass. Using a wide variety of emerging technologies, smarter classrooms will bring the outside world into the class space, affording students the opportunity to participate in increasingly active, hands-on learning activities. Simultaneously, as learning technology becomes more mobile, the smart "classroom" will extend beyond the physical space of a given room, going along with learners wherever they happen to be.

Relevance for Teaching, Learning & Creative Expression

- facilitates e-learning, collaboration among different institutions, and other distributed educational opportunities
- enables centralized access to a variety of reference data and multimedia assets to use in discussion, presentation, or experimentation
- allows multiple means of introducing material, supporting different learning styles of students and highlighting particular aspects of a single concept
- encourages interactive learning

Examples

An entirely new type of classroom is enabled by the GooBall PDA. Each student gets one of these devices, consisting of a PDA, a backpack-cum-power supply, and a thin, touch-sensitive, gooseneck LCD screen. The teacher is placed in the center of the room, which is divided into three work areas using noise-cancellation barriers. In one area, the teacher lectures; the other areas are for group work and individual work. Students move between the spaces as necessary.
http://www.wired.com/news/school/0,1383,51518,00.html

Tsinghua University has developed a smart classroom that incorporates pervasive computing technologies to sense where learners are in the physical space, what they are doing, and what they may need. The lecturer controls the display with voice and gesture.
http://media.cs.tsinghua.edu.cn/~pervasive/projects/classroom/

Rutgers University's C.O.O.L. Classroom (Coastal Ocean Observation Laboratory) brings an oceanography lab right into the middle- and high-school classroom. The C.O.O.L. Classroom allows students to access real-time data collected off the coast of New Jersey and includes lesson plans and a rich array of resources to help teachers use the data in their classrooms.
http://www.coolclassroom.org/home.html

For Further Reading

Technology-enabled Classrooms: Simplicity and Uniformity of Tools Make Them Truly 'Smart.'
(Dan Gordon, *TLtC Contributor*, February 2005.) Discusses the use of smart classrooms at UC Berkeley and pedagogical and technical issues. http://www.uctltc.org/news/2005/02/feature.php

Remote Labs on the Internet Around the World
This list, maintained by the Telelabs Project at the University of Western Australia, links to schools around the world that have remote laboratories for a variety of disciplines accessible over the Internet.
http://telerobot.mech.uwa.edu.au/links.html