

2010 Horizon Report

Preview

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Time-to-Adoption: One Year or Less

Mobile Computing

The mobile market today has nearly 4 billion subscribers, three-fourths of whom live in developing countries. Over a billion new phones are produced each year, and the fastest-growing sales segment belongs to smart phones — which means that a massive and increasing number of people all over the world now own and use a computer that fits in their hand. Third-party applications for all kinds of tasks can now be developed once and ported to a variety of mobile platforms, increasing their availability.

It is these applications that are making mobiles such an indispensable part of our lives. Tools for study, productivity, task management, and more have become integrated into a single device that we grab along with car keys and wallet. More and more, online applications have a mobile counterpart; Blackboard's mobile app, for instance, gives students access to their course materials, discussions, assignments, and grades. Other mobile and handheld devices, such as netbooks, smartbooks, ebook readers, and email readers are also commonly carried. It is easier than ever before to remain connected anytime and anywhere.

Relevance for Teaching, Learning & Creative Expression

- Tablet PCs—small, portable computers that fall in size and function between smart phones and laptops—are used to record and analyze field research during Bluegrass Community & Technical College's off-campus chemistry labs.
- In addition to the free lectures offered on iTunes, many universities are making courses available for mobile delivery.
- Medical students at the University of Louisville School of Medicine use their smart phones to check H1N1 updates from the Center for Disease Control.

Examples

- Following the lead of Japan's Fukuoka-based Cyber University, several colleges in the United States are now offering full, media-rich courses delivered via smart phone: <http://www.universitybusiness.com/viewarticle.aspx?articleid=1233>
- Researchers at the University of Utah have created a mobile application that features a cadaver in various stages of dissection, allowing undergraduate students (who would not otherwise have access) to study real-life anatomy: <https://chronicle.com/blogPost/Want-to-Learn-Anatomy-Theres/8386>
- CourseSmart, a new mobile application, offers over 7000 e-textbooks; each is fully searchable and available via mobile or online: <http://www.coursesmart.com/iphone>

For Further Reading

Teaching with Technology Face-Off: iPhones vs. PC's

<https://chronicle.com/blogPost/Teaching-With-Technology/4547>

(Jeffrey R. Young, *The Chronicle of Higher Education*, 25 February 2009.) One professor found that students with access to an iPhone studied more than those who used only a PC.

World's largest open university goes mobile

<http://www.pr-inside.com/world-s-largest-open-university-goes-r1553595.htm>

(Press release, *PR-inside.com*, 29 October 2009.) The Indira Gandhi National Open University, in partnership with Ericsson, will now offer courses on mobile phones. The classes will reach over 2.5 million students and allow learners in rural India to seek a higher education.

Time-to-Adoption: One Year or Less

Open Content

Open content is a growing movement that focuses on sharing and reusability and thrives on the ready availability of a wide range of educational content. Offering an potential alternative to traditionally published materials such as textbooks that is highly customizable and cost-effective, the open content movement depends on a community of contributors and users who are willing to create and release high-quality educational content in a variety of media at little to no cost.

One effect of open content has been to dramatically increase the availability of information to students and independent learners. As a result, the role of the teacher is undergoing a slow but definite change, from the guardian and dispenser of knowledge to the guide and coach for learners faced with an overabundance of resources. Students have unparalleled access to learning materials; what they need from teachers now is help cultivating the skills of finding, assessing, interpreting, and synthesizing information.

Relevance for Teaching, Learning & Creative Expression

- Open content allows teachers to customize their courses quickly and inexpensively and keep up with emerging information and ideas.
- Open educational resources are available to anyone with an Internet connection, thereby increasing access to education, especially in developing nations.
- Communities of practice and learner groups that form around open content provide a source of support for independent or life-long learners.

Examples

- Folksemantic's OpenCourseWare Finder helps students find free online courses, known as OpenCourseWares, or OCWs: <http://ocwfinder.com>
- OpenLearn, a UK-based open learning site, offers students the opportunity to join a study group, or learn independently; use prepared materials, or join the lab and create their own: <http://openlearn.open.ac.uk>
- MIT's OpenCourseWare—which provides free, online access to all of MIT's courses—serves as a model for other universities: <http://ocw.mit.edu/OcwWeb/web/home/home/index.htm>

For Further Reading

Countries Offer Different Takes to Open Online Learning

<http://chronicle.com/article/Countries-Offer-Different/48775>

(Simmi Aujla and Ben Terris, *The Chronicle of Higher Education*, 11 October 2009.) Many countries are using open educational resources to reach students who would otherwise be unable to attend university.

Students Find Free Online Lectures Better Than What They're Paying For

<http://chronicle.com/article/Students-Find-Free-Online/48776>

(Jeffery R. Young, *The Chronicle of Higher Education*, 11 October 2009.) Not only traditional students, but learners whose primary language is not native, advanced high-school students, and working professionals all take advantage of free educational resources.

Study Finds That Online Education Beats the Classroom

<http://bits.blogs.nytimes.com/2009/08/19/study-finds-that-online-education-beats-the-classroom/?scp=3&sq=higher%20education&st=Search>

(Steve Lohr, *The New York Times*, 19 August 2009.) A study conducted for the Department of Education found that students benefited from the multi-media experience of online learning, most markedly in higher education.

Time-to-Adoption: Two to Three Years

Electronic Books

Electronic books are now accessible via a wide variety of readers, from dedicated reader platforms like the Kindle to applications designed for mobile phones, and are enjoying wide consumer adoption. As screen technology has become more sophisticated, the experience of reading electronic materials has become more comfortable, and the popularity of e-books has increased. Electronic books can be a portable and cost-effective alternative to buying printed books, although most platforms lack features to support advanced reading and editing tasks such as annotation, collaboration, real-time updates, and content remixing.

Electronic books have entered the mainstream in the consumer world and are beginning to make inroads on campuses. The potential for education includes the obvious advantages of lowering costs and making it easier to carry the information contained in several heavy textbooks, but electronic books and readers are also raising questions about the textbook and publishing industries that may have deeper implications in academia.

Relevance for Teaching, Learning & Creative Expression

- Princeton University—which spent over \$5 million on paper last year—issued a Kindle to each student in an effort to eliminate a portion of the paper waste. In addition to e-books, the University plans to digitize much of its library.
- Seton Hall University's Teaching, Learning & Technology Center found that students appreciated the ability to store and review a semester's worth of material in e-book form.
- Amazon's Kindle accepts emails of PDFs and .doc files, which provides students and faculty a convenient method of transporting and reading academic journals.

Examples

- A pilot program at Northwest Missouri State University has determined that students prefer interactive digital readers that allow them to post virtual sticky notes and mark chapters: <http://www.edtechmag.com/higher/march-april-2009/swapping-textbooks-for-e-books.html>
- The University of Virginia's Darden School of Business plans to participate in a program using the Kindle DX: http://www.darden.virginia.edu/html/news_article.aspx?id=19238
- Bookglutton invites users to set up a free online account. Readers choose a book (many at no cost), select a reading group (if desired), and comment on the book as they read: <http://www.bookglutton.com>

For Further Reading

E-Books in Higher Education

<http://ici9.oum.edu.my/pdf/paper06.pdf>

(Jim Sinopoli, for the International Conference on Information, August 2009.) This paper briefly discusses the environment necessary to optimize e-books in higher education.

Clive Thompson on the Future of Reading in a Digital World

http://www.wired.com/techbiz/people/magazine/17-06/st_thompson

(Clive Thompson, *Wired Magazine*, 22 May 2009.) Thompson makes a case for digitizing books: in addition to enhancing sales of the printed book, e-books enable ongoing reader dialogs.

Librarians desperate for e-books as demand outstrips supply

<http://www.timeshighereducation.co.uk/story.asp?storycode=408039>

(Rebecca Attwood, *Times Higher Education*, 10 September 2009.) Publishers needn't worry that e-books will replace paper textbooks: a UK study found that students and faculty prefer to use the e-books as a supplement.

Time-to-Adoption: Two to Three Years

Simple Augmented Reality

The term *augmented reality* (AR) was first coined in 1990 by former Boeing researcher Tom Caudell. The idea is to blend, or augment, primarily location-based data accessed on the web with what we see in the real world. Wireless mobile devices are increasingly driving this technology into the mobile space where the applications offer the most promise. Initially, AR required unwieldy headsets and kept users largely tethered to their desktop computers. With the rise of smartphones and other increasingly powerful mobile devices, many equipped with high-quality cameras and GPS capabilities, AR is showing its legs in a number of applications. The improvement in technology allows more streamlined approaches and wider user adoption. Currently, many AR efforts are primarily based around entertainment and marketing, but will spill into other areas such as education once the technology matures and becomes more simplified.

Augmented reality has strong potential to provide both powerful contextual, *in situ* learning experiences and serendipitous exploration and discovery of the connected nature of information in the real world. Of particular relevance is AR gaming. Creating games based in the real world augmented with various networked data can give gamers and educators powerful new ways to show relationships and connections in the real world.

Relevance for Teaching, Learning & Creative Expression

- MIT's Scheller Teacher Education Program is using AR and exploring its potential in a number of disciplines. They have developed a game called Environmental Detectives using GPS enable devices to uncover the source of a toxic spill.
- The Four Eyes Lab at Univ. of California Santa Barbara is engaged in a number of innovative AR research and demonstration projects.
- AugmentThis! is a mobile service that accepts KML (Google Earth) files, which can then be viewed on an Android phone, overlaying the data through the camera on the phone.

Examples

- ARSights is a website and tool that allows you to visualize your 3D models out of Google Earth, based on the company's AR-Media augmented reality platform: <http://www.arsights.com/>
- Total Immersion created 3D Topps baseball cards and other implementations: <http://www.t-immersion.com/>
- The company Layar has been leading the way in mobile phone AR space with apps for the iPhone and Android phones: <http://layar.com/>

For Further Reading

If You Are Not Seeing Data, You are Not Seeing

<http://www.wired.com/gadgetlab/2009/08/augmented-reality/>

(Brian Chen, *Wired Gadget Lab*, Aug.25, 2009) This *Wired* article gives a good overview of augmented reality, including where it currently is situated and what to expect in the future.

Map/Territory: Augmented Reality Without the Phone

<http://radar.oreilly.com/2009/08/mapterritory-augmented-reality.html>

(Brady Forrest, *O'Reilly Radar*, Aug. 17, 2009) This post covers what augmented reality might look like beyond just using devices like the iPhone.

Mobilizy Proposes Augmented Reality Mark-up Language to The AR Consortium

http://bit.ly/ar_markup

(Ori Inbar, *Games Alfresco.com*, Sept. 22, 2009) This article discusses markup languages for augmented reality browsers that could leverage existing technologies such as Google Earth.

Time-to-Adoption: Four to Five Years

Gesture-Based Computing

Devices that can accept multiple simultaneous inputs (like using two fingers on the Apple iPhone or the Microsoft Surface to zoom in or out) and gesture-based inputs like those used on the Nintendo Wii have begun to change the way we interact with computers. We are seeing a gradual shift towards interfaces that adapt to—or are built for—humans and human gestures. The idea that natural, comfortable movements can be used to control computers is opening the way to a host of input devices that look and feel very different from the keyboard and mouse.

Gesture-based computing allows users to engage in virtual activities with motion and movement similar to what they would use in the real world. Content is manipulated intuitively, making it much easier to interact with, particularly for the very young or for those with poor motor control. The intuitive feel of gesture-based computing is leading to new kinds of teaching or training simulations, that look, feel, and operate almost exactly like their real-world counterparts. Larger multi-touch displays support collaborative work, allowing multiple users to interact with content simultaneously, unlike a single-user mouse.

Relevance for Teaching, Learning & Creative Expression

- Researchers at Georgia Tech University have developed gesture-based games designed to help deaf children learn linguistics at the critical time of language development.
- Using off-the-shelf existing technologies, the Sixth Sense project from MIT provides a gesture interface that can be used to augment information into real world spaces.
- After discovering the significant improvement in dexterity that surgeons-in-training gained from playing with the Wii (48%), researchers are developing a set of Wii-based medical training materials.

Examples

- A number of mobile applications use gestures. *Mover* lets users flick files from one phone to another; *Shut Up*, an app from Nokia, silences the phone when the user turns it upside down; *nAlertme*, an antitheft app, sounds an alarm if the phone isn't shaken in a specific, preset way: <http://www.technologyreview.com/computing/22393/page2>
- As an assignment, several graduate students at Carnegie Mellon University created a virtual snowball fight using PC software and components of Nintendo's Wii: <http://www.post-gazette.com/pg/09308/1010559-96.stm>
- Microsoft's new Project Natal, similar to Nintendo's Wii, engages full-body movement: <http://blog.newsweek.com/blogs/techtonicshifts/archive/2009/11/05/microsoft-s-finally-got-game.aspx>

For Further Reading

University offers new technology to help students study

<http://www.unr.edu/nevadanews/templates/details.aspx?articleid=5194&zoneid=14>

(Skyler Dillon, *Nevada News*, 1 October 2009.) The Mathewson-IGT Knowledge Center at the University of Nevada in Reno purchased two Microsoft Surfaces. In addition to maps and games, the University added an anatomy study guide.

Why Desktop Touch Screens Don't Really Work Well For Humans

<http://www.washingtonpost.com/wp-dyn/content/article/2009/10/13/AR2009101300113.html>

(Michael Arrington, *The Washington Post*, 12 October 2009.) A desktop touch screen isn't comfortable: a more ergonomic design (like an architect's drafting board) would relieve arm fatigue.

Time-to-Adoption: Four to Five Years

Visual Data Analysis

A variety of tools are emerging that make it possible to extract data from large datasets and display it in new ways. These tools do not require sophisticated math skills—as used to be the case to do work of this nature—and they present data in forms that make patterns obvious and intuitive to grasp. Online services such as Many Eyes, Wordle, Flowing Data, and Gapminder accept uploaded data and allow the user to configure the output to varying degrees. Some tools, like Roambi, have mobile counterparts, making it easy to carry interactive, visual representations of data wherever one goes.

The implications for education are that these tools, backed by powerful computers that can easily cope with large amounts of data, will help us understand not only the concepts embedded in large datasets, but also to gain a deeper understanding of learning itself. Capturing and visualizing student data may enable teachers to make better decisions about what and how to teach. The expectation is that tools for gathering, reporting, and visualizing educational data will make it easier to understand where schools are successful, as well as seeing where improvements can be made.

Relevance for Teaching, Learning & Creative Expression

- New apps for mobiles place data visualization in the palm of one's hand: Roambi charts your data, while SimpleMind Xpress is a colorful and intuitive mind-mapper.
- Harvard scientists are using data visualization to measure the expansion velocity of the supernova remnant Chandra.
- With Wordle, students can analyze their papers and see in moments which points need further development, and whether or not certain language has been overused.

Examples

- From simulating the velocity of waves against a ship to visualizing seasonal carbon dioxide accumulation, these videos demonstrate the diversity of data visualization: <http://www.wired.com/wiredscience/2009/08/visualizations/all/1>
- Affecter Interfaces uses analytics to recognize facial expressions; the software charts the mood of the subject: <http://www.techcrunch50.com/2009/affective-interfaces>
- Analytics and data visualization allowed researchers at the University of Pennsylvania to visually capture (in real time) the response of the body's immune system to a parasitic infection: <http://www.upenn.edu/pennnews/article.php?id=1531>

For Further Reading

7 Things You Should Know About Data Visualization II

<http://net.educause.edu/ir/library/pdf/ELI7052.pdf>

(Educause, August 2009.) This article discusses data visualization as it relates to higher education: who's using it, why they're using it, and what to expect in the future.

Data visualization tools for free or cheap

<http://www.innovativeinteractivity.com/2009/05/14/data-visualization-tools-for-free-or-cheap>

(Tracy Boyer, *Innovative Interactivity*, 14 May 2009.) This post offers a brief summary with applicable links to many data visualization sites.

FlowingData Graphs Your Life Via Twitter

<http://www.fastcompany.com/blog/clay-dillow/culture-buffet/flowingdata-graphs-your-life-twitter>

(Clay Dillow, *Fast Company*, 15 July 2009.) Track anything you like via a private Twitter address: every time you have a cup of coffee, blood sugar readings, chocolate cravings, workout time or distances. A graph builds over time of all the data sent in.

Research Question Four

Critical Challenges

The role of the academy—and the way we prepare students for their future lives—is changing.

In a 2007 report, the American Association of Colleges and Universities recommended strongly that emerging technologies be employed by students in order for them to gain experience in "research, experimentation, problem-based learning, and other forms of creative work," particularly in their chosen fields of study. It is incumbent upon the academy to adapt teaching and learning practices to meet the needs of today's learners; to emphasize critical inquiry and mental flexibility, and provide students with necessary tools for those tasks; to connect learners to broad social issues through civic engagement, and to encourage them to apply their learning to solve large-scale complex problems.

New scholarly forms of authoring, publishing, and researching continue to emerge but appropriate metrics for evaluating them increasingly lag behind or fail to appear.

Citation-based metrics are no longer indicative of the relative importance of a given piece of scholarly work; new forms of peer review and approval, such as reader ratings, inclusion in and mention by influential blogs, tagging, incoming links, and retweeting, are arising from the natural actions of the global community of educators. These forms of approval are not yet recognized as significant.

Digital media literacy continues its rise in importance as a key 21st century skill, but there is a widening training gap for faculty and teachers.

Often not seen as a priority for faculty or teacher training, digital media literacy is nonetheless a critical skill not only for students but for those who work with them. Faculty and instructors are beginning to realize that they are limiting their students by not helping them to develop and use digital media literacy skills across the curriculum. This challenge is exacerbated by the fact that it is not clear exactly how to codify the skills or set standards for their measurement.

Institutions increasingly focus more narrowly on key goals, as a result of shrinking budgets in the present economic climate.

Across the board, institutions are looking for ways to control costs while still providing a high quality of service. Schools are challenged by the need to support a steady—or growing—number of students with fewer resources and staff than before. In this atmosphere, it is critical for information and media professionals to emphasize the importance of continuing research into emerging technologies as a means to achieve key institutional goals, such as adequately preparing students to be effective in their fields.

Research Question Five

Key Trends

The abundance of resources and relationships induced by open resources and social networks is increasingly challenging us to revisit our roles as educators in sense-making, coaching and credentialing. Access to educational materials of all kinds has never been so easy or so open as it is today, and this trend is only increasing. The sage-on-the-stage model of teaching, where the instructor holds all the information and all the cards, is simply not applicable in this world of instant access. Educators must respond by changing their roles to reflect the new need to guide and coach students in finding, interpreting, and building an understanding from multiple sources of information.

More and more, people expect to be able to work, learn, study, and connect with their social networks wherever and whenever they want to. We are not tied to desks anymore when we wish to use computers. Workers increasingly expect to be able to work from home or from the road, and most everyone expects to be able to get information, addresses, directions, reviews, and answers whenever they want. Mobile access to information is changing the way we plan everything from outings to errands. A corollary of this trend is the expectation that people will be available and online, anywhere and anytime.

Technologies are becoming more decentralized. The continuing acceptance and adoption of cloud-based applications and services is changing the way we configure and use software and file storage. We readily accept that our work is stored on someone else's servers; we appreciate that our information is accessible no matter which computer we may sit down to use; we are used to the model of browser-based software that does not need to be installed on our computers. Many institutions have found that valuable campus resources are freed up by outsourcing utilities like email and applications. Campuses are responding to this trend in different ways; some are adopting decentralized, hosted solutions, while others are building in-house solutions of their own.

Students are increasingly seen as collaborators, and there is more cross-campus collaboration. Using collaborative technologies, students are working with faculty and peers in other classes and on other campuses to create online resources that both demonstrate learning and contribute to public knowledge. Research projects are conducted by larger, more distributed teams than previously, and they are often becoming more public much earlier in the research process.