Horizon Report: K-12 Edition
2011 Short List

Time-to-Adoption Horizon: One Year or Less

- Cloud Computing
- Collaborative Environments
- Electronic Books
- Mobiles

Time-to-Adoption Horizon: Two to Three Years

- Augmented Reality
- Cellular Networks
- Game-Based Learning
- Open Content

Time-to-Adoption Horizon: Four to Five Years

- Gesture-Based Computing
- Learning Analytics
- Personal Learning Environments
- Wireless Power

Key Trends

Critical Challenges

Cloud Computing

The emergence of very large "data farms" — specialized data centers that host thousands of servers — has created a surplus of computing resources that has come to be called the cloud. Growing out of research in grid computing, cloud computing transforms once-expensive resources like disk storage and processing cycles into a readily available, cheap commodity. Development platforms layered onto the cloud infrastructure enable thin-client, web-based applications for image editing, word processing, social networking, and media creation. Many of us use the cloud, or cloud-based applications, without even being aware of it. Advances in computer science to ensure redundancy and protection from natural disasters have led to data being shared across many different hosting facilities. Improved infrastructure has made the cloud robust and reliable; as usage grows, the cloud is fundamentally changing our notions of computing and communication.

Relevance for Teaching, Learning, or Creative Inquiry

- Cloud-based applications can provide students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools.
- Cloud computing is being used in schools to provide virtual computers to students and staff without requiring each person to own the latest laptop or desktop machine.
- Services like Flickr, YouTube, and Blogger, as well as a host of other browser-based applications, comprise a set of increasingly powerful cloud-based tools for almost any task a user might need to do.

Cloud Computing in Practice

- iLab Central is a remote access project funded by the NSF through MIT and Northwestern University that provides access to sophisticated labs and scientific testing equipment for high school students: http://www.ilabcentral.org
- The state of New York has committed to provide Google App support to 697 public schools across the state, as well as non-public and charter schools: http://googleenterprise.blogspot.com/2010/10/im-in-google-apps-state-of-mind.html
- Stoneware's 1 to 1 Access program provides plug-and-play cloud computing solutions that work with hosted applications like those from Google and Microsoft: http://www.stone-ware.com/cloud/solutions/education.html
- The IBM Cloud Academy is a new initiative to provide cloud computing solutions for K12 and Higher Ed: http://www.ibm.com/solutions/education/cloudacademy/us/en/

For Further Reading

Cloud Migrations Trigger Organizational Challenges
http://www.informationweek.com/cloud-computing/blog/archives/2010/02/cloud_migration.html
(Vanessa Alvarez, *InformationWeek.com*, 9 February 2010.) This article discusses how cloud computing can work if organizations are well structured in advance to take advantage of its affordances.

Google Goes to the Cloud for New Idea in PC System
http://online.wsj.com/article/SB10001424052748704828104576021571135209978.html
(Walter S. Mossberg, The Wall Street Journal, 15 December 2010.) Technology writer Walter Mossberg presents his thoughts on the new cloud-based Google OS Chrome and how it will be used with Google's experimental laptop, the Cr-48.

Strike Up the Band: Over 10 Million Have Gone Google with Apps for Education
http://googleenterprise.blogspot.com/2010/10/strike-up-band-over-10-million-have.html
(Miriam Schneider, Official Google Enterprise Blog, 14 October 2010.) In the four years since Google Apps for Education was launched, over 10 million students now use the cloud-based productivity suite. Now, K12 schools are incorporating the software into their curriculum for students to use.

Collaborative Environments

Collaborative environments are online spaces — often cloud-based — where the focus is making it easy to collaborate and working in groups, no matter where the participants may be. As the typical educator's network of contacts has grown to include colleagues who might live and work across the country, or indeed anywhere on the globe, it has become common for people who are not physically located near each other to collaborate on projects. In classrooms as well, joint projects with students at other schools or in other countries are more and more commonplace as strategies to expose learners to a variety of perspectives.

The essential attribute of the technologies in this set is that they make it easy for people to share interests and ideas, work on joint projects, and easily monitor collective progress. All of these are needs common to student work, research, collaborative teaching, writing and authoring, development of grant proposals, and more. The bar for widespread participation is very low, since the software to support virtual collaboration is low cost or free, and available via a web browser.

Relevance for Teaching, Learning, or Creative Inquiry

- Collaborative environments are an efficient way for students to work together, whether the groups are composed of students in the same physical class or not.
- A class or project group can assemble a collaborative workspace very quickly using widgets that pull information from a range of sources.
- Large-scale collaborative environments can facilitate an almost spontaneous development of communities of people who share similar interests.

Collaborative Environments in Practice

- The Macomb School District in Michigan has started the ASK (Authors, Specialists, and Knowledge) project to help children interact via video conferencing with authors and specialists, enabling them to ask questions and gain further insight into subjects: http://www.twice.cc/ASK/index.html
- GlobalSchoolNet.org is a global network of K12 students and educators who seek to improve teaching and learning through content driven collaboration: http://www.globalschoolnet.org/
- The Teddy Bears Around the World Project is a collaborative initiative that involves children from around the world. Students share their cultures by using teddy bears to help illustrate the unique ways of life in each of their countries: http://www.langwitches.org/blog/travel/teddybearsaroundtheworld/

For Further Reading

Digital Access, Collaboration a Must for Students
http://www.eschoolnews.com/2010/03/16/digital-access-collaboration-a-must-for-students/
(Laura Devaney, *eSchool News*, 16 March 2010.) This article describes the results of an educational technology survey undertaken by Project Tomorrow. The survey identifies a new type of student, the "free agent learner," who creates personal learning experiences.

Howard Rheingold on Collaboration
http://www.ted.com/talks/howard_rheingold_on_collaboration.html
(Howard Rheingold, *TED: Ideas Worth Spreading*, February 2005.) In this talk from 2005, Howard Rheingold discusses the emerging world of collaboration, participatory media and collective action. His insights then are still pertinent today.

Jazz as an Extended Metaphor for Social Computing
http://transliteracies.english.ucsb.edu/post/research-project/research-clearinghouse-individual/research-reports/jazz-as-an-extended-metaphor-for-social-computing
(Aaron McLeran, UC-Santa Barbara Transliteracies Project, 17 May 2009.) This unusual study looks at social computing and jazz and finds some striking — and surprising — similarities.

Electronic Books

Now that they are firmly established in the consumer sector, electronic books are beginning to demonstrate capabilities that challenge the very definition of reading. Audiovisual, interactive, and social elements enhance the informational content of books and magazines. Social tools extend the reader's experience into the larger world, connecting readers with one another and enabling deeper, collaborative explorations of the text. The content of electronic books and the social activities they enable, rather than the device used to access them, are the keys to their popularity; nearly everyone carries some device that can function as an electronic reader, and more people are engaging with electronic books than ever before. New, highly interactive publications demonstrate that quite apart from their convenience, electronic books have the potential to transform the way we interact with reading material of all kinds, from popular titles to scholarly works. Electronic books are being explored in virtually every discipline, and the advantages for students make this technology worth pursuing.

Relevance for Teaching, Learning, or Creative Inquiry

- An obvious draw for students is the advantage of having a single handheld reading device that can easily accommodate the entirety of readings involved in one's study, as well as all the essential reference texts.
- Electronic books provide school districts with a way to acquire books at a very low cost; online resources can be purchased at the district level that grant students free access to thousands of books. In addition to often being less expensive, electronic books are more durable and easier to store than their paper counterparts.
- Electronic book readers can allow students to record, archive, and share commentary and notes about what they are reading, facilitating the work of study groups and research teams.

Electronic Books in Practice

- LibriVox is an online archive of public-domain audiobooks, all recorded by volunteers, including children's content: http://librivox.org
- Blio is an electronic book publisher that creates full color, feature-rich books, ideal for textbook content: http://www.blioreader.com/
- The International Children's Digital Library (ICDL) makes children's literature available online free of charge. Two free iPhone apps let kids read and create books: http://en.childrenslibrary.org/

For Further Reading

Devices to Take Textbooks Beyond Text
http://www.nytimes.com/2009/12/06/business/06novel.html
> (Anne Eisenberg, *The New York Times,* 5 December 2009.) New e-book readers, in addition to displaying standard text, offer liquid-crystal displays to better show graphics and other items found in color in textbooks.

Google: We Will Bring Books Back to Life
http://www.guardian.co.uk/commentisfree/2010/feb/05/google-bringing-books-back-life
> (David Drummond, *Guardian UK*, 5 February 2010.) This article offers perspectives on Google's efforts to digitize millions of books and the value this would have for research, exploration and access to content that would previously have been very difficult for most people.

The Tipping Point: Textbook Politics Meets the Digital Revolution
http://www.texastribune.org/stories/2009/nov/06/tipping-point-texas-textbook-politics-meets-digital-revolution/
> (Brian Thevenot, *The Texas Tribune*, 6 November 2009.) This article cites some of the challenges faced, and promises in store, as state and school agencies begin to consider the adoption of electronic books and readers on a large scale.

Time-to-Adoption: One Year or Less

Mobiles as a category have proven more interesting and more capable with each passing year, and continue to be a technology with new surprises. According to a recent report from mobile manufacturer Ericsson, studies show that by 2015, 80% of people accessing the Internet will be doing so from mobile devices. Perhaps more important for education, Internet-capable mobile devices will outnumber computers within the next year. In Japan, over 75% of Internet users already use a mobile as their first choice for access. This shift in the means of connecting to the Internet is being enabled by the convergence of three trends: the growing number of Internet-capable mobile devices, increasingly flexible web content, and continued development of the networks that support connectivity. The available choices are many — smartphones, tablets, laptops, and the newest class of devices like the iPad that blends the functions of all of them — and the boundaries between them are more and more blurred. It has become common practice to develop web content that seamlessly adjusts for optimal display on whichever of these devices is used to access it, increasing the proportion of Internet applications and information that is accessible to mobile users. Mobile and wireless data networks continue to evolve, supporting faster connections and higher bandwidth throughput; the forthcoming 4G network promises the highest speeds yet, and 4G devices are already beginning to appear on the market.

Relevance for Teaching, Learning, or Creative Inquiry

- At the secondary level, nearly every student carries a mobile device, making it a natural choice for content delivery, reference material storage, and even field work and data capture.
- The suite of tools available for mobile devices, particularly smartphones, continues to grow, adding to the list of references, flash cards, games, and quiz applications available for nearly every subject.
- Mobiles make it possible for students to do meaningful fieldwork, taking measurements and sharing data and findings in ways similar to those used by researchers.

Mobiles in Practice

- Project K-Nect is a project for ninth graders in North Carolina focusing on smartphone use to teach math skills to at risk students: http://www.projectknect.org/Project%20K-Nect/Home.html
- PollEverywhere is an online polling system that is used in conjunction with mobile phones. It is free for educators and the ease of use has made it attractive for classroom exercises. Millard North High School in Omaha, NE is one example of a school using this: http://www.polleverywhere.com/
- St. Joseph School in Trenton, MI used mobile phones in a fourth grade class to record math poems with hipcast and post tem online for their Radio Theater Podcast: http://stjosephschooltrenton.com/blog/?p=58

For Further Reading

School Cell Phone Policies are Changing in Delaware
http://www.examiner.com/k-12-in-wilmington/school-cell-phone-policies-are-changing-delaware
(Lisa Cleveland, Wilmington K-12 Examiner, 31 August 2010.) This piece discusses how some K12 schools in Delaware are relaxing policies allowing students to bring cell phones to school, but have to keep them in their lockers during the day. While still restrictive, this shows administrators are becoming more flexible with these devices.

Classroom Cell Phone Acceptable Use Policy
http://blogs.burrell.k12.pa.us/dlovic/files/2010/05/Classroom-Cell-Phone-Policy.pdf
(Burrell School District, Burrell School District Blog, May 2010.) This is an example of one K12 school's cell phone policy in the Burrell, Pennsylvania School District.

M-Learning: Promises, Perils, and Challenges for K-12 Education
http://education.jhu.edu/newhorizons/Journals/Winter2011/Wallace
(Patricia Wallace, Ph.D., Johns Hopkins University School of Education New Horizons Learning Journal, Winter 2011.) This article details issues and considerations when integrating cell phone use in the K12 classroom.

Time-to-Adoption: Two to Three Years

Augmented Reality

Augmented reality, a capability that has been around for decades, is shifting from what was once seen as a gimmick to a bonafide game-changer. The layering of information over 3D space produces a new experience of the world, sometimes referred to as "blended reality," and is fueling the broader migration of computing from the desktop to the mobile device, bringing with it new expectations regarding access to information and new opportunities for learning. While the most prevalent uses of augmented reality so far have been in the consumer sector (for marketing, social engagement, amusement, or location-based information), new uses seem to emerge almost daily, as tools for creating new applications become ever easier to use.

Relevance for Teaching, Learning, or Creative Inquiry

- 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.
- Students visiting historic sites can access AR applications that overlay maps and information about how the location looked at different points of history.
- Games that are based in the real world and augmented with networked data can give educators powerful new ways to show relationships and connections.

Augmented Reality in Practice

- Handheld Augmented Reality Project (HARP) is a project for middle school students to help teach math and science literary skills using AR technology. The project is developed by Harvard, University of Wisconsin, and MIT: http://isites.harvard.edu/icb/icb.do?keyword=harp
- PairBurst Memory is an augmented reality game designed for children to help improve their memory skills. It was initially designed to help children pass the time while they recover from rehabilitative surgery: http://pairburst.com/
- The Games, Animation, Modeling and Simulation (GAMeS) Lab at Radford University has designed AR games for K12 students using Apple iPhones/iPod Touch and Android smartphones. The story-based participatory game system is called ROAR (Radford Outdoor Augmented Reality): http://gameslab.radford.edu/ROAR.html
- The Powerhouse Museum in Australia has successfully implemented AR using the Layar AR browser to deliver content to iPhone and Android smartphones: http://www.powerhousemuseum.com/layar/

For Further Reading

What is the future of education? An Exploration of Technology and Learning Modalities
http://www.soeducated.com/2010/11/what-is-future-of-education-exploration.html
(Jesse Nickelson, soeducated.com, 16 November 2010.) This post by Washington DC's Director of International Baccalaurette programs discusses some of the benefits of using AR in K12 education. He specifically mentions the AR game Alien Contact as a notable game using AR technology.

Stories of Impact - Harvard's Chris Dede Discussing Augmented Reality in K12 Education
http://www.gse.harvard.edu/impact/stories/faculty/dede.php
(Harvard Graduate School of Education, Harvard University, 5 April 2010.) Education researcher Chris Dede with Harvard's Graduate School of Education discusses the value and research behind using augmented reality in K12 education.

Logical Choice Technologies' Letters Alive AR Platform
http://www.logicalchoice.com/products/letters-alive-curriculum/
(Logical Choice Technologies, logicalchoice.com, accessed 9 March 2011.) This is a new AR platform that integrates into curriculum for pre-kindergarten and kindergarten aged children. It is aimed at teaching children to read using animals and letters in an augmented reality system to both engage and immerse the children in a productive learning environment.

Time-to-Adoption: Two to Three Years

Cellular Networks

The boundaries between cellular networks and the Internet are blurring. Increasingly, and more so in the developing world, the "on ramp" to the Internet is a mobile device accessing the Internet via a cellular network that extends significantly beyond even the electric grid. The 3G cellular networks support broadband Internet, and with self-contained power, can be deployed in even the most remote locations. As the network expands, mobiles are increasingly the access point not only for common tools and communications, but also for information of all kinds, training materials, and more. Because they are always connected, many people are beginning to look to mobile computing platforms as their device of choice. For this group, mobile computing devices are more affordable, more accessible, and easier to use than desktop computers, and provide more than enough functionality to serve as their primary computing device. A major benefit for adoption in schools is that they do not need to build, pay for, or support cellular networks; the infrastructures already surround them.

Relevance for Teaching, Learning, or Creative Inquiry

- A history high school teacher has developed a system using cell phones as clickers to quickly poll students on questions and issues related to the content he teaches.
- As faster 3G and eventually 4G networks come online, these will offer larger bandwidth to students for accessing the web. More complex applications and larger data sets and content can be accessed through these networks.
- Campuses are starting to enable mobile browser friendly versions of their online holding catalogs giving students access to these resources through smartphones that depend on cellular connections to deliver the content.

Cellular Networks in Practice

- Greg Kulowiec uses cell phones as clickers in his high school class in Plymouth, Massachusetts. The system relies on cellular networks in order to deliver results that are then projected to a screen for the students to see: http://blip.tv/file/2088827
- The Essa Academy for K-12 students in the UK has developed a full mobile computing learning environment that relies on a cellular network to deliver content and web access to the students: http://www.essaacademy.org
- North Carolina State relies on cellular networks to provide access to the mobile library network it has established on the campus: http://www.lib.ncsu.edu/m/about.html

For Further Reading

Cisco Visual Networking Index Forecast Projects 26-Fold Growth in Global Mobile Data Traffic From 2010 to 2015
http://newsroom.cisco.com/dlls/2011/prod_013111.html
> (Cisco, Cisco.com, 1 February 2011.) Cisco has released a report that forecasts the growth of global mobile data traffic as more and more of the world adopts faster and more robust cellular networks.

Nine Things You Need to Know About 4G Networks
http://www.appolicious.com/finance/articles/3426-nine-things-you-need-to-know-about-4g-networks
> (Howard Wolinsky, *Appolicious.com*, 7 October 2010.) This post offers a primer on the pertinent aspects of 4G networks that consumers should be aware.

Technology Races to Meet Tide of Data
http://www.nytimes.com/2010/08/02/technology/02iht-NETPIPE02.html
> (Kevin J. O'Brien, *NYTimes.com*, 1 August 2010.) This article discusses how cellular networks are evolving into higher bandwidth networks to help meet the demand for delivery of higher bandwidth content to smartphones and other mobile devices.

Game-Based Learning

Game-based learning has gained considerable traction since 2003, when James Gee began to describe the impact of game play on cognitive development. Since then, research — and interest in — the potential of gaming on learning has exploded, as has the diversity of games themselves, with the emergence of serious games as a genre, the proliferation of gaming platforms, and the evolution of games on mobile devices. Developers and researchers are working in every area of game-based learning, including games that are goal-oriented; social game environments; non-digital games that are easy to construct and play; games developed expressly for education; and commercial games that lend themselves to refining team and group skills. Role-playing, collaborative problem solving, and other forms of simulated experiences constitute topics for further research, but are recognized for having broad applicability across a wide range of disciplines.

Relevance for Teaching, Learning, or Creative Inquiry

- Educational games offer opportunities for both discovery-based and goal-oriented learning, and can be very effective ways to develop teambuilding skills.

- Simulations and role-playing games allow students to re-enact difficult situations to try new responses or pose creative solutions.

- Educational games can be used to teach cross-curricular concepts that touch on many subjects in an engaging way.

Game-Based Learning in Practice

- *Virtual Battlespace II* is a game-based operational simulation environment, developed with the Australian Defense Forces, that is used by militaries all over the world as an operational planning tool: http://www.bisimulations.com

- *Ghosts of a Chance* allows visitors to the Smithsonian American Art Museum a chance to decipher codes, follow treasure maps, send text messages, and uncover hidden objects in this multimedia scavenger hunt: http://ghostsofachance.com/

- *World without Oil* was a collaborative and social imagining of the first 32 weeks of a global oil crisis: http://worldwithoutoil.org/

For Further Reading

Deep Learning Properties of Good Digital Games: How Far Can They Go?
http://www.jamespaulgee.com/node/37
> (James Paul Gee, Arizona State University, January 2009.) This study by noted games-based learning researcher James Paul Gee discusses the design and effects of digital games.

Moving Learning Games Forward (PDF)
http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf
> (E. Klopfer, S. Osterweil and K. Salen, *The Education Arcade*, 2009.) This white paper provides an overview of the field of game-based learning.

Reality is Broken, Game Designers Can Fix It (video)
http://www.avantgame.com/
> (Jane McGonigal, Institute for the Future, 2010.) This TED talk advocates incorporating principles of game design into the real world to effect social change.

Open Content

The movement toward open content reflects a growing shift in the way academics in many parts of the world are conceptualizing education to a view that is more about the process of learning than the information conveyed in their courses. Information is everywhere; the challenge is to make effective use of it. Open content embraces not only the sharing of information, but the sharing of instructional practice and experiences as well. Part of the appeal of open content is that it is also a response to both the rising costs of traditionally published resources and the lack of educational resources in some regions, and a cost-effective alternative to textbooks and other materials. As customizable educational content — and insights about how to teach and learn with it — is increasingly made available for free over the Internet, students are learning not only the material, but also skills related to finding, evaluating, interpreting, and repurposing the resources they are studying in partnership with their teachers.

Relevance for Teaching, Learning, or Creative Inquiry

- The use of open content promotes a set of skills that are critical in maintaining currency in any area of study — the ability to find, evaluate, and put new information to use.

- The same set of materials, once placed online and made sharable via the appropriate licensing, can inform a wide variety of learning modalities, not the least of which is learning for the sheer joy of discovery.

- Sharable materials reduce teacher workloads as they do not need to be recreated from scratch.

Open Content in Practice

- The Open High School of Utah is an online charter high school that leverages next-generation learning technology and strategic one-on-one tutoring to provide students with significantly better learning experiences: http://www.openhighschool.org/

- The K12 wiki project Curriki is an example of extensive open content that has been provided through a network of education partners for use by educators and students: http://www.curriki.org/

- Thinkfinity is a project by the Verizon Foundation to put many K12 education resources online for free access by students and teachers: http://thinkfinity.org/

- Google sponsors the Google Code-in content expressly for K12 students around the world: http://code.google.com/opensource/gci/2010-11/index.html

For Further Reading

An Open Source Platform for Internet-based Assessment
http://grunwald.com/pdfs/Grunwald_Open_Source_Public_Report_v3.pdf
(Grunwald Associates, LLC., 2010.) This report extensively covers the use of open source platforms as a cost-effective and efficient way to conduct assessment. The study also includes results from numerous interviews and sampling efforts.

Curriki's Christine Mytko: Open Education and Policy
https://creativecommons.org/weblog/entry/22899
(Jane Park, CreativeCommons.org, 5 August 2010.) This post is an interview with the Cristine Mytko who is the lead science reviewer with the open source wiki project Curriki. The interview discusses the role of Curriki and open content policy in K12 in education.

How To Get Started with Open Source in K-12
http://thejournal.com/Articles/2010/07/15/How-To-Get-Started-with-Open-Source-in-K-12.aspx?Page=1
(Natasha Wanchek, thejournal.com, 15 July 2010.) This article explores how K12 schools can integrate and use open content. A number of experts in the area give examples of ways that schools can embrace this form of content.

Gesture-Based Computing

Thanks in part to the Nintendo Wii, the Apple iPhone and the iPad, many people now have some immediate experience with gesture-based computing as a means for interacting with a computer. The proliferation of games and devices that incorporate easy and intuitive gestural interactions will certainly continue, bringing with it a new era of user interface design that moves well beyond the keyboard and mouse. While the full realization of the potential of gesture-based computing remains several years away, especially in education, its significance cannot be underestimated, especially for a new generation of students accustomed to touching, tapping, swiping, jumping, and moving as a means of engaging with information.

Gesture-based computing is changing the ways that we interact with computers, both physically and mechanically. As such, it is at once transformative and disruptive. Researchers and developers are just beginning to gain a sense of the cognitive and cultural dimensions of gesture-based communicating, and the full realization of the potential of gesture-based computing within higher education will require intensive interdisciplinary collaborations and innovative thinking about the very nature of teaching, learning, and communicating.

Relevance for Teaching, Learning, or Creative Inquiry

- Gestural interfaces allow users to easily perform precise manipulations that can be difficult to manage with a mouse.

- Gesture-based games like those developed by researchers at Georgia Tech University can help deaf children learn linguistics at a critical time of language development.

- Large multi-touch displays support collaborative work, allowing multiple users to interact with content simultaneously.

Gesture-Based Computing in Practice

- Researchers at MIT are developing inexpensive gesture-based interfaces that track the entire hand: http://web.mit.edu/newsoffice/2010/gesture-computing-0520.html

- The Cedars School of Excellence in Scotland is the first school in the world to distribute an iPad to every student, integrating the device into all facets of education in this K12 institution: http://cedars.inverclyde.sch.uk/wiki/index.php?title=Main_Page

- The Virginia Department of Education (VDOE) is collaborating with Pearson to implement a pilot program that puts fourth, seventh, and ninth grade social studies curriculum on an iPad: http://www.eschoolnews.com/2010/09/30/virginia-using-ipads-to-teach-social-studies/

For Further Reading

Math That Moves: Schools Embrace the iPad
http://www.nytimes.com/2011/01/05/education/05tablets.html
> (Winnie Hu, NYTimes.com, 4 January 2011.) This New York Times article gives examples of how different schools are integrating iPads into the classroom. The author looks and the pros, cons, and promise of this new form of computing for impacting education in the K12 space.

Some Thoughts from the Classroom on iPad 2
http://speirs.org/blog/2011/3/2/some-thoughts-from-the-classroom-on-iPad-2.html
> (Fraser Spiers, speirs.org, 2 March 2011.) Well known iOS Developer and educator Fraser Spiers shares his insight on why the iPad 2 is a powerful tool for education, citing the maturing iOS and the apps that can be used on the device.

What Publishers Can and Should Learn from "The Elements"
http://radar.oreilly.com/2010/08/what-publishers-can-and-should.html
> (Mac Slocum, O'Reilly Radar, 12 August 2010.) This interview with Theodore Gray of Wolfram Research explores the development and thinking behind the groundbreaking iPad eBook *The Elements*, which makes extensive use of gesture-based interfaces to provide a truly interactive experience with the content.

Time-to-Adoption: Four to Five Years

Learning Analytics

Learning analytics promises to harness the power of advances in data mining, interpretation, and modeling to improve understandings of teaching and learning, and to tailor education to individual students more effectively. Still in its early stages, learning analytics responds to calls for accountability on campuses across the country and leverages the vast amount of data produced by students in day-to-day academic activities. While learning analytics has already been used in admissions and fund-raising efforts on several campuses, "academic analytics" is just beginning to take shape.

Learning analytics refers to the interpretation of a wide range of data produced by and gathered on behalf of students in order to assess academic progress, predict future performance, and spot potential issues. Data are collected from explicit student actions, such as completing assignments and taking exams, and from tacit actions, including online social interactions, extracurricular activities, posts on discussion forums, and other activities that are not directly assessed as part of the student's educational progress. Analysis models that process and display the data assist faculty members and school personnel in interpretation. The goal of learning analytics is to enable teachers and schools to tailor educational opportunities to each student's level of need and ability.

Relevance for Teaching, Learning, or Creative Inquiry

- The promise of learning analytics is that when correctly applied and interpreted, they will enable teachers to more precisely identify student learning needs and tailor instruction appropriately.

- If used effectively, learning analytics can help surface early signals that indicate a student is struggling, allowing teachers and schools to address issues quickly.

Learning Analytics in Practice

- The analytics software Socrato has been used to track students in Boston Public High Schools: http://www.socrato.com/solutions/case-studies/

- The Signals system at Purdue University provides tools for faculty to identify and help students through analytical data mining: http://www.itap.purdue.edu/tlt/signals/

- SNAPP analyzes and visualizes data from discussion forum posts to allow teachers to perceive behavioral patterns: http://research.uow.edu.au/learningnetworks/seeing/snapp/index.html

For Further Reading

7 Things You Should Know About Analytics
http://net.educause.edu/ir/library/pdf/ELI7059.pdf
> (EDUCAUSE, April 2010.) This brief report explains how analytics are used for teaching, learning and assessing student progress.

Academic Analytics
http://net.educause.edu/ir/library/pdf/PUB6101.pdf
> (John P. Campbell and Diana G. Oblinger, *Educause*, October 2007.) This paper gives an overview of academic analytics and includes a guide to references and resources.

What are Learning Analytics?
http://www.elearnspace.org/blog/2010/08/25/what-are-learning-analytics/
> (George Siemens, *eLearnspace*, 25 August 2010.) This article presents an overview of learning analytics and discusses how they might be applied in learning institutions.

Personal Learning Environments

Personal learning environments (PLEs) are described as systems for enabling self-directed and group-based learning, designed around each user's goals, with great capacity for flexibility and customization. PLEs are conceived as drawing on a variety of discrete tools, perhaps chosen by the learner, which can be connected or used in concert in a transparent way. While the concept of PLEs is still very new and fluid, it does seem to be clear that a PLE is not simply a technology but an approach or process that is individualized by design, and thus different from person to person. It involves sociological and philosophical considerations and cannot be packaged, passed out and handed around as a cell phone or tablet computer could. Widespread adoption of PLEs, once the tools and approaches are clearer, will almost certainly also require a shift in attitudes toward technology, teaching, and learning.

Relevance for Teaching, Learning, or Creative Inquiry

- PLEs may cater to students with differing learning styles; for instance, visual learners might be able to obtain material from a different source than auditory learners do.

- Students using PLEs may benefit from the practice of keeping track of, and curating, their own resource collections.

- Using PLEs may empower students to take greater control of their learning networks and connections with peers, experts, and others.

Personal Learning Environments in Practice

- A seventh-grader describes her Symbaloo-based PLE and tells how she uses it in class in this 3-minute video: http://www.youtube.com/watch?v=YEls3tq5wIY

- Colorado Libraries has developed a series of lessons for information professionals, culminating in a capstone project to create an individual PLE: http://web20.coceforum.org/the-modules/capstone-your-ple/

- Ph.D. candidate Wendy Drexler documents her middle-grade students' and her own experiences with PLEs: http://teachweb2.blogspot.com/2010/01/personal-learning-environments-student.html

For Further Reading

The "Killer App"- Professional Networked Learning Collaboratives
http://educationinnovation.typepad.com/my_weblog/2010/07/the-killer-app-professional-networked-learning-collaboratives.html
> (Robert Jacobs, Education Innovation blog, 20 July 2010.) This post talks about personal learning networks as an app that can be tailored to fit different groups, in addition to exploring how PLEs have changed as the technology as matured, enabling more people to virtually be part of PLEs that are outside of a specific institution. Additionally, new levels of data sharing and processing can be leveraged in these networks.

The PLN Matures. The Progression of the 21st Century Personal Learning Network
http://theinnovativeeducator.blogspot.com/2010/08/pln-matures-progression-of-21st-century.html
> (Lisa Nielsen. The Innovative Educator Blog, 18 August 2010.) Educator Lisa Nielsen discusses how PLEs have progressed into collaborative creation environments that are more interactive. She also mentions how PLEs are beginning to use social media such as Twitter to further grow and enrich personal learning networks.

5 Ways to Build Your 1.0 and 2.0 Personal Learning Network
> http://theinnovativeeducator.blogspot.com/2010/08/5-ways-to-build-your-10-and-20-personal.html
> (Lisa Nielsen, The Innovative Educator Blog, 1 August 2010.) This post discusses how to build a personal learning network and how this has evolved as online communities and technologies have developed more robust ways to share information and collaborate. The author offers ways to create a PLE through some exercises and examples.

Time-to-Adoption: Four to Five Years

Wireless Power

Anyone who attends a class or meeting where most of the participants have laptop computers is well aware that there are never enough power outlets — and when they are available, they are invariably located in inconvenient places. Wireless power, already being prototyped by several companies, promises to alleviate the problem by making power for charging batteries in devices readily available. Using near-field inductive coupling, power can be transmitted through special surfaces or even through open space to charge devices within a home, office, school, or other setting. Consumer products are already entering the market; the Powermat, for instance, charges up to three devices placed onto its surface (each device must first be slipped into a compatible sleeve). Fulton Innovation's eCoupled technology is designed to be built into desk and countertops, enabling not only power transfer but also other wireless communications between devices placed on the surfaces. Witricity is developing transmitters that would be embedded in walls or other furniture, transferring power via inductive coupling to receivers attached to devices anywhere within the home or classroom. However, it is important to note that there have been health risks associated with using wireless power that need to be resolved before wide-scale adoption.

Relevance for Teaching, Learning, or Creative Inquiry

- Research is underway to explore the use of wireless power as a means to keep electrical implants powered and running inside of patients.
- As electric vehicles become more commonplace, wireless power technologies are being developed so that these can be charged without being tethered to wall power.
- Mobile consumer devices such as smartphones and tablets can be charged wirelessly using a growing number of products designed to charge the devices by placing these on charging mats instead of plugging them into the wall

Wireless Power in Practice

- Powercast is developing wireless smoke detectors and other sensors: http://www.powercastco.com
- Devices can be placed on Powermat's sleek black mats to wirelessly charge them: http://www.powermat.com
- eCouple has developed a wireless charging device that can wirelessly charge the Tesla electric car: http://thenextweb.com/shareables/2011/01/06/ces-2011-the-worlds-first-wirelessly-powered-tesla-car
- Nextreme Thermal Solutions is developing a device that can use heat as a source of electricity to charge low power devices: http://www.nextreme.com/pages/power_gen/apps/thermobility.shmtl

For Further Reading

Bye Bye Battery
http://www.hemagazine.com/node/22415
> (Mark Elson, *Home Entertainment Magazine*, 18 January 2011.) Ph.D. Student Paul Theilmann is conducting research into wireless charging technology involving a sensor that can collect unused radio waves and turn them into power instead of needing batteries to charge devices.

eCoupled Wireless Power White Papers
http://ecoupled.com/en/wireless-power/white-papers
> (*eCoupled.com*, accessed 8 March 2011.) These are two white papers outlining wireless power and how it can be applied. One paper gives an overview of wireless power for consumers and the other one goes into detail about the history of wireless power and the need for a universal wireless charging power solution.

The End of Cell Phone Chargers is Near
http://www.livescience.com/technology/end-cell-phone-chargers-100831.html
> (Adam Hadhazy, *LiveScience.com*, 31 August 2010.) Wireless charging options are beginning to proliferate and evolve. This article discusses some of the both wired and wireless technologies that may help free us from carrying traditional chargers for our mobile devices.

Key Trends

The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators. This multi-year trend was again ranked very highly, indicating its continued influence. Institutions must consider the unique value that each adds to a world in which information is everywhere. In such a world, sense-making and the ability to assess the credibility of information are paramount. Mentoring and preparing students for the world in which they will live — the central role of the university when it achieved its modern form in the 14th century — is again at the forefront.

As IT support becomes more and more decentralized, the technologies we use are increasingly based not on school servers, but in the cloud. The continuing acceptance and adoption of cloud-based applications and services is changing not only the ways we configure and use software and file storage, but even how we conceptualize those functions. It does not matter where our work is stored; what matters is that our information is accessible no matter where we are or what device we choose to use. Globally, in huge numbers, we are growing accustomed to a model of browser-based software that is device-independent. While some challenges still remain, specifically with notions of privacy and control, the promise of significant cost savings is an important driver in the search for solutions.

Blogs, open textbooks, electronic journals, and forms of expression embodied in new media formats are challenging the notions of academic writing. These techniques are increasingly common and are readily accepted as informal outlets for student work. A more gradual trend toward official acceptance is moving slowly, but its stirrings are visible in the adoption of electronic content, experiments with crowd-sourcing, and open, online peer review of work. This trend is related to the challenge of developing metrics for evaluating such work, noted in 2010 as well as again this year.

Devices like Apple's iPad are filling a niche that is neither 'big smartphone' or 'small laptop.' As more people use, and discuss the ways they are finding to use, devices like the iPad, it is becoming clear that these are neither oversized phones nor stripped-down laptops. Instead, they represent a new class of devices that perhaps we were not even aware we wanted until they became available — and almost ubiquitous. They are more and more commonly seen, and are already gaining a footing in education, the health industry, and other sectors as tools for learning and for serious work.

It becomes more and more evident every year that students are not deeply engaged in learning at school. Studies have shown that this lack of engagement contributes to the rate of early dropouts, yet students still struggle to find personal relevance in much of what they are asked to do in school. Efforts to alter this trend, such as project- or challenge-based learning pilot programs, mentoring, and community involvement in learning, show promise. Even with these positive steps, it is clear that this trend will not be an easy one to reverse.

One-to-one computing is spreading to a large number of countries and regions. Providing students constant access to computers and the Internet is an education game-changer. Current studies have been tracking and analyzing the ways in which one-to-one computing is impacting student achievement in class, and the early results are promising. A key driver behind the adoption of this model is how well it complements both project- and challenge-based learning, which already have proven correlations to increasing student engagement.

People expect to be able to work, learn, and study whenever and wherever they want to. This highly-ranked trend, noted last year, continues to permeate all aspects of daily living. Life in an increasingly busy world where learners must balance demands from home, work, school, and family poses a host of logistical challenges with which today's ever more mobile students must cope. A faster approach is often perceived as a better approach, and as such people want easy and timely access not only to the information on the network, but to their social networks that can help them to interpret it and maximize its value. The implications for informal learning are profound, as are the notions of "just-in-time" learning and "found" learning, both ways of maximizing the impact of learning by ensuring it is timely and efficient.

The perceived value of innovation and creativity is increasing. Innovation is valued at the highest levels of business and must be embraced in schools if students are to succeed beyond their formal education. The ways we design learning experiences must reflect the growing importance of innovation and creativity as professional skills. Innovation and creativity must not be linked only to arts subjects, either; these skills are equally important in scientific inquiry, entrepreneurship, and other areas as well.

Technology continues to profoundly affect the way we work, collaborate, communicate, and succeed. Information technologies impact how people work, play, learn, socialize, and collaborate. Increasingly, technology skills are also critical to success in almost every arena, and those who are more facile with technology will advance while those without access or skills will not. The digital divide, once seen as a factor of wealth, is now seen as a factor of education: those who have the opportunity to learn technology skills are in a better position to obtain and make use of technology than those who do not. Evolving occupations, multiple careers, and an increasingly mobile workforce contribute to this trend.

Critical Challenges

The demand for personalized learning is not adequately supported by current technology or practices. The increasing demand for education that is customized to each student's unique needs is driving the development of new technologies that provide more learner choice and control and allow for differentiated instruction. It has become clear that one-size-fits-all teaching methods are neither effective nor acceptable for today's diverse students. Technology can and should support individual choices about access to materials and expertise, amount and type of educational content, and methods of teaching.

Digital media literacy continues its rise in importance as a key skill in every discipline and profession. The challenge is due to the fact that despite the widespread agreement on its importance, training in digital literacy skills and techniques is rare in teacher education and school district professional development programs. As teachers begin to realize that they are limiting their students by not helping them to develop and use digital media literacy skills across the curriculum, the lack of formal training is being offset through professional development or informal learning, but we are far from seeing digital media literacy as a norm. This challenge is exacerbated by the fact that digital literacy is less about tools and more about thinking, and thus skills and standards based on tools and platforms have proven to be somewhat ephemeral.

Economic pressures and new models of education are presenting unprecedented competition to traditional models of schools. 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. As a result, creative institutions are developing new models to serve students, such as streaming survey courses over the network. As these pressures continue, other models may emerge that diverge from traditional ones. Simply capitalizing on new technology, however, is not enough; the new models must use these tools and services to engage students on a deeper level.

A key challenge is the fundamental structure of the K-12 education establishment — aka "the system." As long as maintaining the basic elements of the existing system remains the focus of efforts to support education, there will be resistance to any profound change in practice. Learners have increasing opportunities to take their education into their own hands, and options like informal education, online education, and home-based learning are attracting students away from traditional educational settings. If the system is to remain relevant it must adapt, but major change comes hard in education.

Learning that incorporates real life experiences is not occurring enough and is undervalued when it does take place. This challenge is an important one in K-12 schools, because it results in a lack of engagement in learning on the part of students who are seeking some connection between their own lives and their experience in school. Use of technology tools that are already familiar to students, project-based learning practices that incorporate real-life experiences, and mentoring from community members are a few practices that support increased engagement. Practices like these may help retain students in school and prepare them for further education, careers, and citizenship in a way that traditional practices are failing to do.

Many activities related to learning and education take place outside the walls of the classroom. Students can take advantage of learning material online, through games and programs they may have on systems at home, and through their extensive — and constantly available — social networks. The experiences that happen in and around these venues are difficult to tie back to the classroom, as they tend to happen serendipitously and in response to an immediate need for knowledge, rather than being related to topics currently being studied in school.

Putting 21st century technology into 19th century schools is a major undertaking. The 19th century school systems are still ubiquitous, from the outdated, industrial nature of old buildings to the old learning models and processes upheld therein. Schools must adopt 21st century technology to overcome the challenge of the current linear archetypes. These new tools are the antidote; organic and non-linear, 21st century technology facilitates the freedom for students to quickly discover information whenever they need it. In turn, they develop more sophisticated skill sets that open the doors to four-year universities and better jobs.

We need to build curriculum that allows for a mixture of experiences and online learning. Traditional lectures and subsequent testing are still dominant learning vehicles in schools. In order for students to get a well-rounded education with real world experience, they must also perform group work outside the classroom that is accompanied by online exploration. The goal of this curriculum is for students to work with peers in other schools, connecting with each other online to design projects that incorporate local or global issues. While the students complete the project individually at their respective schools, the groups convene to review the project scope and present the results. The blended learning experience fosters a better grasp of project development, online collaboration, and ultimately encourages students to think outside the four walls of their classrooms and experience learning within communities.

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