2011 Horizon Report: K-12 Edition
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Time-to-Adoption: One Year or Less

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. Applications like Flickr, Google, YouTube, and many others use the cloud as their platform, using storage space and computing resources from many available machines as needed.

Cloud computing currently includes three broad areas of development: cloud-based applications, which are designed for many different tasks and which are hosted in the cloud; development platforms for creating cloud-based applications; and massive computing resources for storage and processing. 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

- Stoneware's 1 to 1 Access program teams with Dell to provide 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 by IBM to provide cloud computing solutions for K12 and Higher Ed: http://www.ibm.com/solutions/education/cloudacademy/us/en/
- 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

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.

Time-to-Adoption: One Year or Less

Mobiles

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 mobiles in K12 classrooms.

Time-to-Adoption: Two to Three Years

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.

Proponents of game-based learning point to its role in supporting collaboration, problem-solving, and communication, the 21st century competencies needed by American students outlined by Secretary of Education Arne Duncan in late 2010 in the National Education Technology Plan. Advocates also underscore the productive role of play, which allows for experimentation, the exploration of identities, and even failure. Gaming also contributes to the development of a particular disposition well-suited to an information-based culture and rapid change.

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.

Time-to-Adoption: Two to Three Years

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.

This philosophy of open content and open education acknowledges that information is not the only useful and distributable commodity among educators. Understanding, insight, and experience can also be collected and shared. An outgrowth of that perspective is the emergence of open-content textbooks that can be "remixed" — that is, customized, modified, or combined with other materials — and the resulting new combinations can be shared in turn. A number of publishers are working on ways to support authors and consumers of such materials.

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/
- 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/
- 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/
- 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.

Time-to-Adoption: Four to Five Years

Learning Analytics

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.

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 need not simply focus on student performance. It might be used as well to assess curricula, programs, and institutions. It could contribute to existing assessment efforts on a campus, helping provide a deeper analysis, or it might be used to transform pedagogy in a more radical manner. It might also be used by students themselves, creating opportunities for holistic synthesis across both formal and informal learning activities.

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.

Time-to-Adoption: Four to Five Years

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=YEls3tq5wlY
- 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.

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.

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.

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.

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