

2010 Horizon Report: K-12 Edition

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Time-to-Adoption: One Year or Less

Cloud Computing

The cloud is the term for the myriad of servers and other computers, often located in enormous data centers, that power the Internet. New cloud applications harness the unused resources of these computers to distribute applications, storage, and even processing power to users in ways that are increasingly useful, low cost, and ubiquitous. Applications like Gmail use the cloud as their platform, in the way that programs on a desktop computer use that single computer as a platform. Cloud-based applications use storage space and computing resources from many available machines as needed. “The cloud” denotes any group of computers used in this way. Improved infrastructure has made the cloud robust and reliable; as usage grows, the cloud is fundamentally changing our notions of computing and communication.

Many emerging technologies are supported in some way by the cloud: collaborative environments and tools like Ning, PageFlakes, Voicethread, and Google Apps are cloud applications. A wide variety of online communication tools are supported by cloud resources and many, many personal web tools are cloud-based. Data storage is cheap in these environments — pennies per gigabyte — so cheap that it is often provided in surprising quantities for free. Specialized applications like Flickr and YouTube provide options for hosting and sharing media; tools for creating multimedia projects, like Prezi and Vuvox, live in the cloud; and most social platforms, including Facebook, do as well. To the end user, the cloud is invisible, and the technology that supports the applications does not matter — the fact that the applications are always available, no matter what device is used to access them, is key.

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.

Wikis, which allow many authors to add content to a web site, were one of the first technologies in this category, and it is increasingly rare to find a collaboration that does not use a wiki in one form or another. The largest example is Wikipedia, which through the efforts of thousands of contributors, has become the world’s *de facto* encyclopedia. One of the largest examples of an online environment built expressly to enable collaboration is Google Apps, which includes a set of commonly used productivity tools, but configured in a way to make it easy to work in teams.

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.

Time-to-Adoption: Two to Three Years

Educational Gaming

The interest in educational gaming has accelerated considerably in recent years, driven by clear successes in military and industrial training. The US military, in particular, is using games and simulations to refine skills across the range of their training needs, from basic training to field medicine, to IED removal, to advanced operational strategies. Developers and researchers are working in every area of educational gaming, 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. At the low end of game technology, there are literally thousands of ways games can be applied in learning contexts. Role-playing and other forms of simulated experiences have broad applicability across a wide range of disciplines, and are another rich area for exploration.

Still a few years away, but increasingly interesting, is the notion of creating massively multiplayer online (MMO) games expressly for learning, along the lines of games created for entertainment (e.g. World of Warcraft) or for both training and entertainment, such as America's Army, created by the US military. MMOs bring many players together in activities that require them to work together to solve problems; they can be collaborative or competitive. They are often goal-oriented in ways that tie to a storyline or theme, but high levels of play often require outside learning and discovery. What makes this category of games especially compelling and effective is the multiple ways participants can be engaged — with other players, with the “back story,” in social contexts, and more — and the time they are willing to spend on task pursuing the goals of the games.

Mobiles

Mobiles as a category have proven more interesting and more capable with each passing year. The mobile market today has more than 4 billion subscribers, more than two-thirds of whom live in developing countries. Well over a billion new phones are produced each year, a flow of continuous enhancement and innovation that is unprecedented in modern times. 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 and is able to connect to the network wirelessly from virtually anywhere. Tens of thousands of applications designed to support a wide range of tasks on virtually any smart-phone operating system are readily available, with more entering the market all the time. These mobile computing tools have become accepted aids in daily life, giving us on-the-go access to a wide range of tools for business, video/audio capture and basic editing, sensing and measurement, geolocation, social networking, personal productivity, references, just-in-time learning — indeed, virtually anything that can be done on a desktop — and arguably more.

In developed countries, it is quite common for young people to carry their own mobile devices. In the upper grades, it is not at all unusual, indeed commonplace, to find schools in which every student carries a mobile, even if they are not allowed to use them during class. The unprecedented evolution of these devices continues to generate great interest, and their increasing capabilities make them more useful with each new generation of devices. The ability to run third-party applications represents a fundamental change in the way we regard mobiles and opens the door to a myriad of uses for education, entertainment, productivity, and social interaction.

Time-to-Adoption: Four to Five Years

Augmented Reality

The term *augmented reality* (AR) was first coined in 1990 by former Boeing researcher Tom Caudell, who used it to describe ways in which digital information could be overlaid in real time with the visual information we are used to seeing in the real world. (Heads-up displays in aircraft were an early outgrowth of the technology.) While the capability to deliver that sort of augmented reality experience has been around for decades, it has up to recently always required a very expensive customized system, or special equipment. Advances in mobile devices as well as in the different technologies that combine the real world with virtual information have led to augmented reality applications that are as near to hand as any other application on a laptop or a smart phone.

Emerging augmented reality tools to date have begun to overlay marketing, amusement, or location-based information via heads-up displays or real-time video, and new applications continue to appear as the technology becomes more popular. As they have, augmented reality is now poised to enter the mainstream in the consumer sector. Learning applications, such as the ability to overlay information over a video image of an historical site, or an artifact in a museum are not far behind.

Thin Film Displays

Computer displays continue to develop in ways that are enabling whole new categories of devices. Flexible screens that can wrap around curved surfaces are in prototype, as are small, very thin interactive screens like the Plastic Logic Reader (<http://www.plasticlogic.com/>). Thin film screen technology allows displays to be literally printed onto plastic, along with the batteries that power them, enabling the sorts of live motion displays previously only hinted about in Harry Potter movies. Already in the marketplace is “video in print,” very thin flexible displays that can be easily inserted into popular magazines; CBS and Entertainment Weekly were first to demonstrate this new technology in the fall of 2009. When the technology is developed fully it will enable integrated interactive display devices that combine input and output in a single interface, finally realizing the full potential of electronic paper.

Thin film displays, because of their flexibility and low cost, are certain to become part of everyday educational materials like periodicals, textbooks, and imaging tools. Manufacturers like Sony, Phillips, and Samsung are working on bringing flexible and ultra-thin screens to market. Based on organic light-emitting diode (OLED) technology, in which the pixels emit their own light, these sorts of screens can be extremely thin. Since no separate light source is required, OLED screens can easily be placed into all manner of devices. While perhaps best thought of as an enabling technology at this point, with learning applications still some years away, the displays thin film technology enables are so cheap and so easily manufactured that whole new categories of devices using them are likely.

Key Trends

Technology is increasingly a means for empowering students, a method for communication and socializing, and a ubiquitous, transparent part of their lives. Technology is impacting all of our lives, and especially the lives of students, in new and expanding ways. Once seen as an isolating influence, technology is now recognized as a primary way to stay in touch and take control of one's own learning. Multisensory, ubiquitous, and interdisciplinary, technology is integrated into nearly everything we do. It gives students a public voice and a means to reach beyond the classroom for interaction and exploration.

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.

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.

There is increasing interest in just-in-time, alternate, or non-formal avenues of education, such as online learning, mentoring, and independent study. More and more, the notion of the school as the seat of educational practice is changing as learners avail themselves of learning opportunities from other sources. There is a tremendous opportunity for schools to work hand-in-hand with alternate sources, to examine traditional approaches, and to reevaluate the content and experiences they are able to offer.

The way we think of learning environments is changing. Traditionally, a learning environment has been a physical space, but the idea of what constitutes a learning environment is changing. The "spaces" where students learn are becoming more community-driven, interdisciplinary, and supported by technologies that engage virtual communication and collaboration. This changing concept of the learning environment has clear implications for schools.

Critical Challenges

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.

Students are different, but educational practice and the materials that supports it are changing only slowly. Schools are still using materials developed to teach the students of decades ago, but today's students are actually very different in the way they think and work. Schools need to adapt to current student needs and identify new learning models that are engaging to younger generations. Many education professionals feel that a shift to a more learner-centered model focused on the development of individual potential instead of the imposition of a body of knowledge would lead to deeper and more sustained learning across the curriculum. To support such a change, both teaching practice and the tools used in the classroom must adapt. Assessment has also not kept pace with new modes of working, and must change along with teaching methods, tools, and materials.

Many policy makers and educators believe that deep reform is needed, but at the same time, there is little agreement as to what a new model of education might look like. It is difficult to envision profound change in a system as firmly established as K-12 education is today. Proponents of change promote more learner-centered approaches; open content; programs for continuing teacher professional development in partnership with higher education institutions; and the use of social networking tools to increase access to peers and professionals for both teachers and students, but not everyone is in agreement. Opinions also differ on how to make progress at all and whether it is better to build success slowly, using pilots and small proof-of-concept classrooms, or to push for rapid and radical change on a broader scale.

A key challenge is the fundamental structure of the K-12 education establishment. 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 — but these experiences are often undervalued or unacknowledged. Beyond the classroom walls, students can take advantage of online resources, explore ideas and practice skills using games and other programs they may have on systems at home, and interact with their extensive — and constantly available — social networks. Within the classroom, learning that incorporates real life experiences like these is not occurring enough and is too often 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 world, their own lives, and their experience in school.