HORIZON REPORT

2009 K-12 EDITION

The New Media Consortium

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EXECUTIVE SUMMARY

The *Horizon Report* series is the product of the New Media Consortium's Horizon Project, an ongoing research project that seeks to identify and describe emerging technologies likely to have a large impact on teaching, learning, research, or creative expression within education around the globe. This volume, the *Horizon Report: 2009 K-12 Edition,* is the second in a new series of regional and sector-based reports, and examines emerging technologies for their potential impact on and use in teaching, learning, and creative expression within the environment of pre-college education. The hope is that the report is useful to educators worldwide, and the international composition of the Advisory Board reflects the care with which a global perspective was assembled. While there are many local factors affecting the practice of education, there are also issues that transcend regional boundaries, questions we all face in K-12 education, and it was with these in mind that this report was created.

Each edition of the *Horizon Report* introduces six emerging technologies or practices that are likely to enter mainstream use in the educational community within three adoption horizons over the next one to five years. To identify these areas, the project has drawn on an ongoing conversation among knowledgeable persons in the fields of business, industry, and education; on published resources, current research, and practice; and on the expertise of both the NMC community and the communities of the members of the Horizon Project's K-12 Advisory Board, an international body of experts in education, technology, and other fields. The Advisory Board, chosen to broadly represent a range of perspectives in K-12 education, engages in a discussion around a set of research questions intended to surface significant trends and challenges and to identify a wide array of potential technologies for the *Report.* Using a process detailed in the methodology section, the Advisory Board comes to a consensus about the six topics that will appear here. The examples and readings under each topic area are meant to provide practical models as well as access to more detailed information. Wherever possible, an effort was made to highlight the innovative work going on among elementary, middle, and high schools around the world.

The format of the *Horizon Report* reflects the focus of the Horizon Project, which centers on the applications of emerging technologies to teaching, learning, research, and creative expression. Each topic opens with an overview to introduce the concept or technology involved and follows with a discussion of the particular relevance of the topic to education or creativity. Examples of how the technology is being — or could be — applied to those activities are given. Each description is followed by an annotated list of additional examples and readings which expand on the discussion in the Report, as well as a link to the list of tagged resources collected by the Advisory Board and other interested parties during the process of researching the topic areas. Many of the examples under each area feature the innovative work of NMC member institutions and their school partners.

Technologies to Watch

The technologies featured in this K-12 edition of the *Horizon Report* are placed along three adoption horizons that represent what the Advisory Board considers likely timeframes for their entrance into mainstream use for teaching, learning, or creative applications in the K-12 environment. The first adoption horizon assumes the likelihood of entry into the mainstream of schools within the next year; the second, within two to three years; and the third, within four to five years.

This edition was prepared concurrently with the release of the *2009 Horizon Report,* and it was natural that the Advisory Board considered the technologies presented there, along with a great many others, and they did, but with an eye toward evaluating their likely adoption in K-12 schools. As

the project got underway, there was considerable interest in seeing how similarly K-12 and higher education were viewing emerging technology. As it turned out, there is a considerable overlap, but there are also clear distinctions. Assessment and filtering greatly impact the degree to which some technologies can be adopted in schools, which helps to explain the considerable variation in adoption time frames between the two sectors.

The first two topics featured in this edition, *collaborative environments* and *online communication tools,* are similar to topics that have appeared in past *Horizon Reports;* both groups of technologies are now standard in the digital toolset of postsecondary students. In many grade schools, on the other hand, integrating these kinds of technologies into teaching and learning has proven difficult because of barriers such as policy constraints on using online tools, the fact that many students do not bring laptops to school (as opposed to many college students, who do), and policies that restrict Internet access in many schools. We are starting to see the erosion of some of these barriers as mobile devices become more capable and as the value of these tools for collaborative work becomes more evident. Over the next year, we anticipate that both groups of technologies will begin to move into the mainstream of teaching practice.

In the mid-term horizon are *mobiles* and *cloud computing.* Though both appear in the *2009 Horizon Report* as technologies that will become mainstream in higher education, they are on the near-term horizon for colleges and universities. The Advisory Board's estimate of two to three years as a likely timeframe for their adoption in the K-12 sector is a reflection of the fact that younger students are, at present, less likely than college-age students to carry mobile devices, especially Internet-capable ones — although there is a growing trend that suggests this will not always be the case — and that access to cloud-based applications is more difficult for younger students for the same reasons that collaborative environments and online communication tools are often out of reach.

On the far horizon we see *smart objects* and *the personal web.* Smart object appliances aimed at consumers are appearing on the market, and the technology shows promise for linking physical objects with rich caches of online content, but common use in schools is still several years away. The technology was placed on the same horizon in the higher education edition of the *2009 Horizon Report.* The personal web, on the other hand, is perceived as being slightly closer to mainstream adoption in higher education than in grade schools; the topic appears on the mid-term horizon for higher education.

Two themes arose repeatedly during discussions of these technologies: assessment and filtering. Assessment continues to present a challenge to educators at all levels, particularly in the context of new media and collaborative work; evaluating student work that includes blogs, podcasts, and videos, or establishing how much an individual student contributed to or learned from a collaborative project, is difficult. Further, translating assessments of this nature into the metrics measured by standardized tests is not at all straightforward. The issue of assessment touches every topic in this report. Likewise, the practice of filtering — limiting the kinds of online content and tools that students have access to while at school — is intimately related to each of these topics. At many schools today, the technologies named here cannot be used because they are blocked by content filters. The Advisory Board recognized the need for new tools for filtering that do a better job of keeping objectionable content out of the way while allowing useful tools and content to be accessed.

The body of the report describes each profiled technology in detail, including its relevance to teaching, learning, and creative expression. Specific examples that reflect the level of adoption as of the writing of this report are also included, and a list of suggested readings is provided for those who might want further information. Taken together, our research indicates that each of these six technologies will have a significant impact on schools within the next five years.

- **Collaborative Environments** The value placed on collaboration is increasing in the workplace as professionals are expected to work across geographic and cultural boundaries more and more frequently. Many teachers recognize the importance of collaborative work and are finding that online tools to support it provide them and their students with opportunities to work creatively, develop teamwork skills, and tap into the perspectives of people around the world with a wide range of experiences and skills that differ from their own.

- **Online Communication Tools** Communication tools are a part of most students' daily lives outside of school. Instant messaging and online chats via desktop video conferencing are common means for social interaction with family and friends. As technology provides ways for teachers to help shape the constructive use of communication tools in the classroom, a new world of experiences is opening up for students. With most applications costing little or nothing to implement, few other technologies available today have the ability to remove geographic and time limitations from school environments more quickly than online communication tools.

- **Mobiles** Commonly carried by most college students, many high school students, and a growing number of younger students, mobiles have been evolving rapidly in recent years. Multi-touch interfaces, GPS capability, and the ability to run third-party applications make today's mobile device an increasingly flexible tool that is readily adapted to a wide range of tasks for social networking, learning, and productivity. In some places, mobile devices like the iPhone have already begun to supplant portable computers as the Internet-capable device of choice.

- **Cloud Computing** The rise of large-scale "data farms" — large groups of networked servers — has made processing power and storage capacity available in abundant quantities.

Applications that are developed to run in the cloud and take advantage of the ability to scale up or down along with the number of users and storage demands are changing the way we think about programs and files. Collaborative work, research, social networking, media sharing, virtual computers: all are enabled by applications that live in the cloud.

- **Smart Objects** Smart objects combine a unique identifier with sensors and network access to link physical objects with a wealth of virtual information. Some smart objects include it all, combining the ability to sense themselves and their surroundings with the ability to control a computer or access online content; others are merely everyday objects that have been tagged with a special code that connects them to the virtual world. The underlying technologies that support smart objects are not new, but we are now seeing new kinds of sensors, identifiers, and applications with a much more generalizable set of functionalities.

- **The Personal Web** Finding and organizing online content related to personal interests and learning objectives can be a difficult task, given the quantity of information on the web and the ease of adding more. Keeping track of one's own contributions, and those of valued peers and colleagues, adds another layer of complexity. There are a number of technologies that are used to configure and manage the ways in which we view and use the Internet; taken together, this toolset is the personal web: a growing set of free and simple tools and applications that let us create customized, personal web-based environments that explicitly support our social, professional, learning, and other activities.

Key Trends

In addition to the six technologies named above, the K-12 Horizon Advisory Board also researched, identified, and ranked key trends affecting the practice of teaching, learning, and creative expression in

K-12 schools. Through a review of current articles, interviews, papers, and research, the Board captured emerging or continuing trends they considered important, and in the end, nearly 30 such trends were identified. Each was ranked according to how significant an impact they were likely to have on K-12 education in the next five years; the top five are presented below.

- *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.

- *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 our lives, and 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.

- *The web is an increasingly personal experience.* We have an unprecedented level of control over online content, not only in terms of the information and activities that we select, but also in the way they are represented to us. Students are very familiar with the idea of "skinning" — customizing the look and feel of — their virtual experiences. They expect and experience personalized content in games and websites that is at odds with what they find in the classroom.

- *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, where learning is the key focus of the space.

- *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.

Critical Challenges

The K-12 Advisory Board also identified critical challenges facing schools as they seek to integrate new technologies into the established structures of teaching and learning environments. To develop the list of over thirty challenges facing schools today, the Advisory Board reviewed current events, papers, articles, and similar sources, ultimately ranking the five challenges below as those most likely to affect teaching, learning, and creativity in the K-12 arena over the next five years.

- *There is a growing need for formal instruction in key new skills, including information literacy, visual literacy, and technological literacy.* New skills are required of students in writing and communication, different from those of even a

few years ago. Students and teachers both are finding it necessary to be technologically adept, to be able to collaborate on a global scale and to understand content and media design. Issues of assessment and integration of new literacies across the curriculum, and of teacher training, are complicated by the overarching need for a fuller understanding of what constitutes new literacy skills.

■ *Students are different, but educational practice and the material that supports it is 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.

■ *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.

■ *There is a growing recognition that new technologies must be adopted and used as an everyday part of classroom activities, but effecting this change is difficult.* Technology tools that are part of everyday life for many students and working professionals should be seen as core tools of the teaching profession that teachers are required to master as any professional would master the tools of his or her trade. However, making such a profound shift in a well-established system is a difficult challenge. Professional development, intellectual interactions with peers, adequate training, and preparation time — all scarce resources for teachers — are necessary in abundance for such a shift to take place.

■ *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.

These trends and challenges reflect the impact of emerging technologies and practices on our lives. They demonstrate the change that is taking place in the way we communicate, access information, and connect with peers and colleagues. Taken as a whole, they frame the conversation around the potential impacts of the six technologies and practices described in this special edition of the *Horizon Report.*

The Horizon Project

Since the launch of the Horizon Project in March 2002, the NMC has convened an ongoing series of

conversations and dialogs with hundreds of technology professionals, campus technologists, faculty leaders from colleges and universities, and representatives of leading corporations from more than two dozen countries. For the past six years, these conversations have resulted in the publication each January of a globally focused report on emerging technologies relevant to higher education. Each year, as the report is produced, an Advisory Board engages in focused dialogs using a wide range of articles, published and unpublished research, papers, scholarly blogs, and websites. The result of these dialogs is a list of the key technologies, trends, challenges, and issues that knowledgeable people in technology industries, higher education, and museums are thinking about.

Last year, for the first time, the NMC embarked on a new series of regional and sector-based companion editions of the Horizon Report, with the dual goals of understanding how technology is being absorbed using a smaller lens, and also noting the contrasts between technology use in one area compared to another. This report, the *Horizon Report: 2009 K-12 Edition,* is the second of these new publications; the *Horizon Report: 2008 Australia-New Zealand Edition,* released in the fall of 2008, was the first.

Like the global effort from which these emerged, the K-12 project, referred to informally as *Horizon.K12,* used qualitative research methods to identify the technologies selected for inclusion in the report, beginning with a survey of the work of other organizations and a review of the literature with an eye toward spotting interesting emerging technologies. When the cycle started, little was known, or even could be known, about the appropriateness or efficacy of many of the emerging technologies for these purposes, as the Horizon Project expressly focuses on technologies not currently in widespread use in schools. For the current report, nearly 80 of these were initially considered.

The 45 members of this year's Advisory Board were purposely chosen to represent a broad spectrum of K-12 education, as well as key writers and thinkers from business and industry. They engaged in a comprehensive review and analysis of research, articles, papers, blogs, and interviews; discussed existing applications, and brainstormed new ones; and ultimately ranked the items on the list of candidate technologies for their potential relevance to teaching, learning, and creative expression. Much of this work took place in and around a remarkable face-to-face gathering in Dallas in January 2009, using a variety of tools specially purposed for the project; additional work took place online from January through the end of February 2009. Work from the meeting as well as the online discussions were captured and may be reviewed on the project wiki at http://horizon.nmc.org/k12.

For additional background on the Horizon K-12 project, please see the section on methodology at the end of the report.

COLLABORATIVE ENVIRONMENTS

Time-to-Adoption Horizon: One Year or Less

Collaborative environments are virtual workplaces where students and teachers can communicate, share information, and work together. A growing emphasis on collaboration in education — and an increasing recognition that collaboration is the norm in many modern workplaces — has led more teachers to seek tools to facilitate group interaction and teamwork in their classes. Online spaces designed to support groups of students working together take many forms, from relatively simple tools that lend themselves to multiple simultaneous authors all the way up to full-fledged classroom environments in both the flat web and the 3D world of virtual environments. Collaborative environments provide the means for students to work with peers both local and distant, practice creative teamwork, and develop peer relationships.

Overview

Collaborative environments exist in a myriad of forms. They can be simple web-based tools for collaborative work, social networking platforms, community websites, classroom management systems, multiplayer gaming environments, or even virtual worlds. The common features that unite collaborative environments are that multiple people can work within them at once; that users can leave evidence of their thoughts, and reflections on the thoughts of others; and that they can support users in any location at any time.

At one end of the spectrum are tools like Voicethread (http://voicethread.com) that make it easy to collect multiple voices and viewpoints in a single media package. Shared document editors like Adobe Buzzword (http://www.adobe.com/acom/buzzword/), Google Docs (http://docs.google.com), and wikis allow collaborators to author a single document simultaneously. Social networking tools like Facebook (http://www.facebook.com) and MySpace (http://www.myspace.com) combine highly-customizable user profiles with collaborative tools; these spaces are aimed at social interaction rather than educational use, but they have nonetheless been used by teachers and classes to create a shared online space. Users can embed multimedia, including video, music, and images, into pages, tagging other users to associate them with a given piece of work.

More fully-featured systems like Ning (http://ning.com), Moodle (http://moodle.org), or PageFlakes (http://pageflakes.com) let teachers set up workspaces that include web feeds to pull in relevant resources, chat spaces — both synchronous and asynchronous, forums, profiles, shared documents, calendars, music, and a host of other tools, all with a few clicks. Wikis can be used in the same way. Designed to be easy to use, online collaborative environments like these make it very easy to create custom online classroom spaces for any subject.

Collaboration within 3D virtual worlds and multiplayer gaming environments takes a slightly different form, as the participants' interactions can be more along conversational lines, and shared products are often virtual artifacts rather than text or other flat media. Students often find these spaces very engaging. Programs like HiFives (http://ced.ncsu.edu/hifives/) and GRADUATE (http://wolfden.fi.ncsu.edu/GRADUATE/Home.html) are designed to explore how students might use such spaces to develop skills in math, sciences, information technology, and other STEM subjects. In these projects, teachers collaborate with students in university game design programs using inexpensive gaming engine software to design environments and challenges for their 5th – 8th grade classes. Similar efforts are underway by Global Kids (http://www.globalkids.org/) to investigate the use of the virtual world of Second Life™ for K-12 education.

Collaborative environments of all kinds extend the classroom, eroding geographic and time limitations

that used to constrain academic interactions. Students can work on group homework assignments with their peers whether or not they are able to get together physically, and can receive feedback and coaching from teachers outside of school hours, if both parties wish. The removal of such limitations is accompanied, however, by questions about the security of information shared online, a major concern for schools. Protection of student work as well as the responsibility for keeping students in safe places on the web — without limiting intellectual access to high quality sites — are both challenges schools are working to address.

Relevance for Teaching, Learning, or Creative Expression

As noted above, collaborative environments foster teamwork and collaboration, but students can also develop individual skills in such spaces. By practicing critical thinking in a more or less public forum, students can benefit from seeing what their peers have to say and from critiquing each other's work. In a world where factual information exists side by side with incorrect or misleading statements and opinions stated as facts, students must learn to critically examine what they see and hear. Collaborative environments provide workspaces in which such activities may take place in an open, constructive way, linked to classroom content. For example, social studies classes use iCue (http://www.icue.com/), a site produced by NBC News, to "collect" news stories, share them, and reflect and respond to the perspectives presented by the news media.

Collaboration in an in-class setting presents teachers with the challenge of capturing and managing ideas that often come and go in student discussions at a very fast pace. Such dialog is beneficial to students and supports constructivist learning goals, but assessment can be difficult in real time. Collaborative environments can be used to record such conversations in various ways, so that both teachers and students can revisit and review discussions throughout the school year. Blogs and wikis are ideal

means for this, as are visual tools like Mindmeister (http://mindmeister.com), a web application that makes it easy to attach discussion points around a central issue. The map can be recorded and replayed to review who contributed at each point; since it resides online, students can continue the discussion from any Internet-enabled computer.

Online collaborative environments invite global initiatives. The Center for 21st Century Skills has developed a space in the virtual world of Second Life called the International Virtual Collaboration Space to support students working with their peers around the world. Students in Finland and in Connecticut will be using the space to design collaborative projects (see http://www.youtube.com/watch?v=K_1n3iNBsG8 for a 7-minute video describing the space). Students working in collaborative environments also have opportunities to connect with experts, professionals, researchers, and others beyond their classroom walls. A collaboration between the LA MEDiA Quick Start Collaborative based at Los Angeles Valley College, the California MEDiA Statewide CTE Hub, and partners in media production, film, and animation has resulted in an online collaborative space where students from kindergarten through college can work on film and media projects, receive feedback from other students and professionals, and maintain a learning portfolio that follows them throughout their education and career (see http://marypickford. com/images/stories/movies/la-media-promo-main-sequence_h264_400kbs_640x480.mov).

The benefits of collaborative environments extend to professional interactions for teachers as well. Shared professional spaces create opportunities for teachers to dig deeper, ask questions of their colleagues, explore projects that others are doing, and engage in ongoing professional development wherever they happen to be. Classroom 2.0 (http://www. classroom20.com/) is a community of nearly 20,000 teachers that is supported by the Ning environment; the teachers can join interest groups within the larger community, post and respond to questions, share links, and take part in deep discussions about

integrating emerging web technologies into the practice of teaching. RezEd.org (http://rezed.org) uses a similar space for professional development around teaching with virtual worlds, as does the Flat Classroom Project (http://flatclassroomproject.ning.com/) for collaborative projects.

A sampling of applications of collaborative environments across the curriculum includes the following:

- **Language Arts** Students at the International School of Bangkok are part of a collaborative community made up of students from four other schools around the world. Using blogs and podcasts to share their reading and writing strategies, they sharpen reading and writing skills by collaboratively authoring class blogs and producing informative podcasts for other elementary school students.

- **Natural Sciences** Students in New York City and Chicago collaborated with researchers in the program *I Dig Tanzania,* a collaboration between Global Kids and the Field Museum of Chicago's Biodiversity Synthesis Center. Teen Second Life was used to support the students' collaboration and learning about paleontology and Tanzanian culture (see http://www.holymeatballs.org/2008/08/idt_i_dig_tanzania_promo_video.html).

- **U.S. History** An 8th grade history teacher at Del Mar Middle School in California uses a wiki customized with primary source material, polls, videos, and images as a workspace for his students to investigate and analyze U.S. history. The students do research online, prepare their arguments collaboratively and singly in the wiki as homework, and then discuss their findings in class (see http://delmarhistory8.wikispaces.com/).

Collaborative Environments in Practice

The following links provide examples of how collaborative environments are being used in schools.

Always Learning: Projects
http://mscofino.edublogs.org/projects/

At the International School Bangkok, students in kindergarten through fifth grade collaborate with their peers around the world using a range of methods including social networking tools, collaborative workspaces, blogs, wikis, and microblogging tools.

Avatars
http://voicethread.com/share/235108/

Students at the University of Southern California's School of Cinematic Arts worked with a local school to integrate inexpensive, easy collaboration tools into first and second grade classes. "Avatars" was created by second graders using Voicethread to share their personal avatars and express the reasons for their artistic choices.

Connected.info
http://connected.info

Students at the Center for Advanced Research and Technology, a high school in Clovis, California, use Connected.info to collaborate on assignments. Students can create blog posts, edit group wiki pages, contribute to discussion forums, and share notes online.

Learning Library
http://www.newmedialiteracies.org/ll2/NMLLL.html

Scheduled for release in May 2009, the Learning Library presents a variety of interactive learning challenges that are designed for students to work through. The challenges are structured to encourage practice and exploration in new media literacy skills.

SWIFT
http://www.swiftclassroom.com

> SWIFT is a collaborative environment building tool designed for teachers to quickly and easily publish class websites. Teachers can make updates quickly, stay in touch with parents, and keep students informed of classroom assignments and policies. Several schools districts in the Puget Sound, Washington area and a few international schools in Africa use SWIFT district-wide.

Youth Media Exchange
http://ymex.org/

> Youth Media Exchanges is a partnership between Global Kids and TakingITglobal, in association with the Asia Society. The groups use a social network to support youth in the U.S. and Asia as they develop 21st century learning skills while collaborating on creative projects based on global issues.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about collaborative environments.

Collaboration Tools
http://connect.educause.edu/Library/ELI/CollaborationTools/47200

> *(Cyprien Lomas, Michael Burke, and Carrie Lee Page,* EDUCAUSE Connect *(White Paper), August 2008.)* This white paper discusses collaboration tools used by students, ways that students already use them, and ways that faculty can leverage students' familiarity with and use of collaboration tools to extend discourse beyond the classroom.

Edublogging: Instruction for the Digital Age Learner (PDF)
http://bonsall.schoolwires.com/15121092621254 77/cwp/view.asp?A=3&Q=277322&C=55071

> *(Jeffrey P. Felix, Ed.D.)* This white paper is a study of blogging use in K-12 schools in the United States. The author also considers teachers' perceptions of how blogging is influencing their own instruction methods.

Implementation Study #3: Moodle
http://www.k12opentech.org/implementation-study-3-moodle

> *(Steve Hargadon,* K-12 Open Technologies, *17 January 2008.)* This study reviews Moodle, an open source collaborative online classroom environment, from the perspective of its applicability to K-12.

Social Networks in Education
http://socialnetworksined.wikispaces.com/

> This wiki site hosts an updateable list of social networks online that are used in school environments.

Top 10 Web 2.0 Tools for Young Learners
http://www.thejournal.com/articles/23898_1

> *(Chris Riedel,* T.H.E. JOURNAL, *February 2009.)* This article highlights ten high quality online tools, some of which use some social networking in the classrooms of younger students.

Delicious: Collaborative Environments
http://delicious.com/tag/zk09+collabworkspaces

> *(Tagged by K-12 Horizon Advisory Board and friends, 2009).* Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hzk09" and "collabworkspaces" when you save them to *Delicious.*

ONLINE COMMUNICATION TOOLS

Time-to-Adoption Horizon: One Year or Less

As more professionals work from remote or distributed locations, the need for cheap, flexible communication tools has grown. Recent technological developments are creating more ways for users to work anytime and anywhere, and these new tools are finding their way into homes and classrooms as well. Online communication tools put students in touch with distant family members, practicing experts, and their peers, wherever they may be located. Desktop videoconferencing, instant messaging services, microblogging platforms, and voice-over-IP clients facilitate connections and the dissemination of information between and among students and teachers, keeping classroom communities in touch with each other on a more extensive basis than ever before.

Overview

The tools for remote communication that are used by professionals are easily adaptable to teaching and learning, and indeed we are seeing an increase in classroom use of programs for that purpose. Such tools make it easy for students to move past the classroom walls and connect with their peers around the world as well as giving them access to experts in fields they are studying. Online communication tools may be synchronous or asynchronous; based in text, audio or video; and enable one-to-one, one-to-many, or many-to-many communications. Many may be used either from a computer or an Internet-enabled mobile phone, and some can be used from almost any mobile phone.

Brief, synchronous online communication through instant messaging, and near-synchronous or asynchronous conversations via Twitter (http://twitter.com), a microblog application, allow dialogs that are not bound by physical space or time limits. Meebo (http://meebo.com), a web-based instant messaging aggregator, eliminates the need for schools to support software from a variety of instant messaging vendors by enabling access to different accounts in one interface. There are mobile clients for both Twitter and Meebo, meaning that access to text communications is possible on the go as well. Synchronous online communication through instant messaging is a part of many people's daily lives, and this includes K-12 students. Many schools are now beginning to see instant messaging as a learning tool rather than a distraction. This requires new approaches to classroom management in order to optimize learning and limit unhelpful communications.

Programs like Skype (http://skype.com) allow free online video conferencing, which many young people already use to communicate with their extended families. Now a student in Jacksonville, Florida may be as likely to speak to a peer in India as to a grandparent in Minnesota. Desktop video conferencing knocks down classroom walls and brings subject experts and co-learners from all over the world into the classroom. Ustream (http://www.ustream.tv) makes it easy to broadcast video to the web, either as a live event or as a recording, pairing the broadcast with a chat window for remote participation. Such opportunities present great advantages to students who are now expected to develop skills valued by the international work community such as communication skills and global and cultural awareness.

Online communication tools developed with schools in mind offer additional features. Edmodo (http://edmodo.com) is a private microblogging platform that gives teachers and students a sheltered place to manage classroom assignments and activities as well as engage in protected conversations. YackPack (http://yackpack.com) combines live voice, a visual presence for speakers, text messaging, and the ability to record and archive sessions in a friendly interface designed for school use. There are many tools like these available, and they continue to be developed day by day.

Relevance for Teaching, Learning, or Creative Expression

The value of online communication tools goes well beyond social interaction. Access to these tools gives students an opportunity to experience learning in multiple ways, to develop a public voice, to make connections with others around the world, and to compare their own ideas with those of their peers.

The best moment to teach a student something is the moment they are curious about it — but what about when that moment happens outside of classroom hours? Online communication tools create opportunities for "the teachable moment" even if students are at home, at the mall, on a field trip, or anywhere else. Students in Greenville, South Carolina can take part in live conversations anytime with their teacher through Gabbly (http://gabbly.com), a chat widget that is embedded into their teacher's website. Anytime communication also helps make students available to teachers when needed. Teachers can manage classroom activities even outside of classroom hours through synchronous, two-way online communication that can provide time-sensitive information about projects and assignments and reach multiple students at once.

The combination of social interaction and meeting an expert in a subject provides avenues for deep learning, but student field trips are necessarily limited and not every opportunity can be followed. Desktop videoconferencing offers unique solutions to these issues. While videoconferencing in the commercial world has been around for quite some time, standard equipment and technology requirements often make that type of communication unfeasible for schools. Web-based communication tools for video conferencing, which are often free and require only a webcam and a moderately high speed internet connection, open up new opportunities for virtual visits to relevant locations and for interactive conversations with specialists. Capturing such a conversation creates an instant reference: students at Philadelphia's Science Leadership Academy (SLA), a public high school, use Ustream to view class discussions and presentations for study and review, or to make up for a missed class.

The types of experiences made possible by online communication tools give students opportunities to learn in nontraditional ways. Debate, dialog, demonstration, conversation, and other means for exploring the many sides of a topic are all natural ways to interact using these tools. While a shorthand form of writing is commonly used in text messages, students still need to develop their ideas in order to express them; and tools that make use of audio or video encourage students to articulate their thoughts clearly in order to be understood.

A sampling of applications for online communication tools across the curriculum includes the following:

- **Social Studies** Students in Worcester, Massachusetts used Skype to communicate their experiences at the inauguration of President Barack Obama to fellow students in Massachusetts and Maine, and to a TV crew at WBZ in Boston, in real time. The middle and high school students at home asked questions using both video and chat in Skype.

- **Mathematics** A school in Salem, Oregon uses YackPack in an ongoing math project called Math Scene Investigation (MSI). Students use YackPack to collaborate on solving math problems with a criminal investigation twist.

- **History** A collaboration between The History Channel, the New York Historical Society, Ustream.tv and Verizon brought American history expert, David McCullough, into classrooms via Ustream's desktop video conferencing service so students could talk with him about George Washington on Presidents Day 2008.

Online Communication Tools in Practice

The following examples provide snapshots of how online communication tools are being applied in practice.

Around the World 2008

http://www.pvhs.k12.nj.us/atw/atwindex.asp

An annual project at Passaic Valley High School in New Jersey connects students with their peers around the world using videoconferencing, email, chat, and other online tools.

Board Connect: Anacortes School District Board of Directors

http://board.asd103.org/

Several districts in Washington state, including the Anacortes School District, use an online communication tool called BoardConnect to facilitate school board meetings and communicate information to parents and teachers.

Fishbowl 101

http://learningandlaptops.blogspot.com/2006/10/fishbowl-101.html

A Colorado teacher uses a process she calls "the fishbowl," in which an inner circle of students discusses class material while an outer circle of students live blogs the discussion and carries on one of their own in the blogs.

NML Mapping Think Tank

http://projectnml.tumblr.com/

MIT's project New Media Literacies (NML) used a Tumblr blog to collect resources, examples, and ideas around applying new media literacies to geography. The blog was built as a conversation among project members.

Zoey's Room

http://www.zoeysroom.com/

Zoey's Room is an online community for middle school girls that fosters creativity in STEM subjects. One of the features is a chat room where girls can converse with "Fab Females," professional women who have careers in science, technology, engineering, and math.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about online communication tools.

Around the World with 80 School Projects

http://langwitches.org/blog/2009/01/10/skype-interview-around-the-world-with-80-schools-project/

(*Sylvia Tolisano,* Langwitches, *10 January 2009.*) The author, a technology integration facilitator in Jacksonville, Florida, is interviewed by Howard Wolinsky about her use of Skype to facilitate student interactions with 80 other schools around the world.

Edmodo is Twitter for Education

http://mashable.com/2008/09/18/edmodo/

(*Doriano"Paisano"Carter,* Mashable, *September 2008.*) This post describes Edmodo, a microblogging application that allows teachers to communicate with groups of students anytime.

A Live Lesson on George Washington

http://www.ustream.tv/blog/2008/02/13/500/

(*Brad Hunstable,* The Ustream.tv Blog, *13 February 2008.*) This blog post describes a live, interactive online conversation between noted historian David McCullough and students via Ustream.

Online Videoconferencing: Web Tools Such as Ustream Make Video Broadcasting Accessible

http://www.accessmylibrary.com/coms2/summary_0286-34670276_ITM

(*Gary Stager,* District Administration, *June 2008.*) This article provides an overview of major online video technologies used in K-12 classrooms and examples of how they are used.

Delicious: Online Communication Tools

http://delicious.com/tag/hzk09+commtools

(*Tagged by K-12 Horizon Advisory Board and friends, 2009.*) Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hzk09" and "commtools" when you save them to *Delicious.*

MOBILES

Time-to-Adoption Horizon: Two to Three Years

It is becoming increasingly common for young people to own mobile devices. In the upper grades, it is not at all unusual to find that students carry mobiles, even if they are not allowed to use them during class, and younger students often carry them as well. 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. One recent feature — the ability to run third-party applications — represents a fundamental change in the way we regard mobiles and opens the door to myriad uses for education, entertainment, productivity, and social interaction.

Overview

Every edition of the *Horizon Report* since 2006 has had something to say about mobiles. Mobiles are ubiquitous to the point that they affect every sector and every region. Over the past few years, mobiles have undergone a continual transformation, becoming more capable and flexible with each new release. The ability to record audio and video turned them into portable multimedia devices; as storage capacity increased, they became keepers of our family photos, phone books, and calendars; and now, geolocation, web browsing, and email have brought much of the functionality of a laptop to the pocket-sized devices. In countries like Japan, young people equipped with mobiles often see no reason to own personal computers.

In a marketplace that turns out 1.2 billion new phones each year, innovation is fluid and ever-present. A recent survey by the Pew Internet & American Life Project predicts that by the year 2020, most people across the world will be using a mobile device as their primary means for connecting to the Internet (http://www.pewinternet.org/PPF/r/270/report_display.asp). It is clear that mobiles are already well on the way to becoming a universal tool for communication of all kinds.

About a year ago, another round of new developments took place in the mobile markets — developments that have resulted in a profound change in the way we think about and interact with mobile devices. A new generation of mobiles appeared on the market featuring multi-touch displays, the ability to access the Internet over increasingly higher-speed 3G networks or by using wifi, and the capability for sensing motion and orientation and reacting accordingly using built-in accelerometers. Thanks to built-in GPS, these new devices can locate themselves. They can run robust applications, and they can communicate with and control other devices. Most significantly, their manufacturers are working with the broader community to open up the devices to all the innovation enabled by third-party developers.

The applications being developed have nothing to do with making phone calls. Rather, they expand the capacity of mobiles to keep us in touch with information and activities that we want while we are on the move. Third-party applications are very easy to acquire and install. Commonly priced at just under a U.S. dollar, they include games, reference materials, tools for measuring and calculating, checklists, reading material, productivity applications, social networking tools, and more. In the elementary and secondary sector, applications exist for nearly every subject, from English to history, mathematics, and science. The most common materials are designed for reference and drill, but there are also creative applications for music and art, as well as calculators, reading aids, language aids, and interactive games and simulations.

Applications designed for mobiles can take advantage of built-in features like the microphone and the camera. Ocarina, for instance, is an application for the iPhone that turns the phone into a flute that is

played by blowing into the microphone and tapping buttons on the screen. BeeTagg Reader uses the camera to snap a picture of a quick response (QR) code, decoding it and displaying the associated information.

The rapid pace of innovation in this arena continues to increase the potential of these little devices, challenging our ideas of how they should be used and presenting additional options with each new generation of mobiles. While there are policy constraints that limit the use of mobiles in schools, it is apparent that the devices and their new applications have been accepted in the mainstream. As more young people carry mobiles, some innovative schools are beginning to consider how to use mobiles as tools for K-12 education.

Relevance for Teaching, Learning, or Creative Expression

Mobiles are already in use as tools for education on many college and university campuses. At the secondary level, nearly every student carries a mobile device, making it a natural choice for content delivery and even field work and data capture. New interfaces, the ability to connect to wifi and GPS in addition to a variety of cellular networks, and the availability of third-party applications have created a device with nearly infinite possibilities for education, networking, and personal productivity on the go. The combination of available applications and a device that they carry anyway provides an opportunity to introduce students to tools for study and time management that will help them in later life. The implications for K-12 education are dramatic: the potential for mobile gaming and simulation, research aids, field work, and tools for learning of all kinds is there, awaiting development.

Even mobiles that cannot run third-party applications can be used in the classroom. One of the simplest applications is to use short messaging system (SMS) messages to allow student response in place of expensive clicker systems. Products like Poll Everywhere (http://www.polleverywhere.com/) let teachers set up questions online and use a web page to tabulate, graph, and display the results to the class. Students can see, for example, how their answers as a class differ in pre- and post-quiz situations.

Third-party educational applications are readily available for the newest mobiles, and educational content is easy to find for almost every discipline. More sophisticated tools that tap into the unique capabilities of mobile devices like the touch screen, the camera, the microphone, and the accelerometer are quickly emerging. Language learners can look up words; practice listening, speaking, and writing; and compare their pronunciation with a native speaker's. Graphing calculators display 3D graphs that can be rotated with a finger on the touch screen or viewed from different angles by tilting the phone. Detailed reference materials for medicine or astronomy include the ability to supplement information and illustrations with online sources. The variety and quality of educational content is growing at a fantastic pace.

A sampling of mobile applications across the curriculum includes the following:

- **Mathematics** In addition to applications for flash cards and simple drill practice, math tools for mobiles like Kids' Fraction Fun (http://www.nscpartners.com/kidsmathfun62233) help students practice skills they are learning in school in a game-like format on the iPod Touch.

- **Science** Mobiles can be used to photograph results of experiments in the lab or outdoors. Students can take measurements using tools like Seismometer (http://coneri.se/iphone/), or perform calculations with tools like ChemiCal (http://www.twssworldwide.com/ChemiCal.html).

- **Art History** Students in Bath, England, will be using Mscape (http://mscapers.com) to create media maps of historical sites in and around the Holburne Museum and Sidney Gardens. Using cameras and mobile devices, the students will develop materials that can be used to raise interest in the site among the community.

Mobiles in Practice

The following examples provide snapshots of how mobile devices are being used in schools.

Google Earth for iPhone

http://googleblog.blogspot.com/2008/10/introducing-google-earth-for-iphone.html

> The iPhone version of Google Earth includes all the detail of the desktop version and is available in 18 languages.

Mobile MAAP

http://maap.columbia.edu

> Columbia University's Mapping the African American Past (MAAP) website now includes a mobile version designed to be viewed using the iPhone or iPod Touch.

Panoramio

http://android-developers.blogspot.com/2008/09/panoramio.html

> Panoramio is an application for Android mobiles that brings up a map of the user's current location and then shows photographs that were taken in the area.

ZooZBeat

http://www.zoozmobile.com/zoozbeat.htm

> ZooZBeat is an iPhone application featuring a gesture-based musical studio that is easy enough for beginners and also robust enough for professional musicians.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about mobiles.

The Future of the Internet III

http://www.pewinternet.org/PPF/r/270/report_display.asp

> *(Janna Anderson and Lee Rainie, Pew Internet & American Life Project, December 14, 2008.)* This report describes the results of a survey of Internet leaders, activists, and analysts assessing predictions about technology and its roles in the year 2020.

How Mobile Is Changing Our Society

http://tarina.blogging.fi/2008/10/18/speaking-at-mobile-monday-amsterdam/

> *(Teemu Arina, Tarina, 18 October 2008.)* This blog post explores the blurring boundary between mobile devices and computers and the potential future of what we now call mobiles.

iPhone: 3 Features That Will Impact Education

http://www.edutechie.com/2007/06/iphone-3-features-that-will-impact-education/

> *(Jeff VanDrimmelen, EduTechie.com, 12 June 2007.)* This blog post describes three features of the iPhone — multi-touch display, widgets, and iPhone applications with full Internet access — and explains why the author believes they will make a difference for education in particular.

Mobile Learning in Classrooms of the Future

http://www.convergemag.com/story.php?catid=421&storyid=108262

> *(Suren Ramasubbu & Bruce Wilcox, Converge, September 2008.)* This article describes the potential of smart phones to revolutionize K12 education.

Voice in Google Mobile App: A Tipping Point for the Web?

http://radar.oreilly.com/2008/11/voice-in-google-mobile-app-tipping-point.html

> *(Tim O'Reilly, O'Reilly Radar, 18 November 2008.)* This blog post discusses the release of speech recognition for searching with Google Mobile App for iPhone and its implications for developing computing services designed to be native to phones.

Delicious: Mobiles

http://delicious.com/tag/hzk09+mobile

> *(Tagged by K-12 Horizon Advisory Board and friends, 2009.)* Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report*. To add to this list, simply tag resources with "hzk09" and "mobile" when you save them to *Delicious.*

CLOUD COMPUTING

Time-to-Adoption Horizon: Two to Three Years

The cloud refers to computing resources resulting from very large "data farms" — specialized data centers that host thousands of servers. Cloud computing uses the surplus resources to lower the cost and increase the availability of disk storage and processing power to the point that anyone can obtain it, almost at a moment's notice, very cheaply. Applications that run in the cloud can scale up or down depending on immediate demand, and many of us use such applications daily without even being aware that they are cloud-based. Image editors, word processors, social networking tools, and more are always available. Accessed via a web browser, they are often free and come with huge amounts of storage space for whatever we wish to keep there. The infrastructure has improved to the point that the cloud is robust and reliable. As usage grows, the cloud is changing our ideas about computing and communication.

Overview

The *cloud* is the term for networked computers that distribute processing power, applications, and large systems among many machines. Applications like Flickr (http://www.flickr.com), Google (http://www.google.com), YouTube (http://www.youtube.com), and many others 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 do not run on a single computer; instead they are spread over a distributed cluster, using storage space and computing resources from many available machines as needed. "The cloud" denotes any group of computers used in this way and is not tied to a particular location or owner, though many companies have proprietary clouds. "Amazon's cloud," for instance, refers to the computers used to power Amazon.com; the capacity of those servers has been harnessed as the Elastic Compute Cloud (EC2) and can be leased from Amazon for a variety of purposes.

Cloud computing tools help us work, learn, communicate, and collaborate. Most of the technologies featured in this edition of the *Horizon Report* are supported in some way by the cloud: collaborative environments and tools like Ning, PageFlakes, Facebook, and Voicethread are cloud applications; online communication tools are supported by cloud resources; web-based counterparts to mobile applications run in the cloud;

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.

There are cloud-based counterparts to many common software tools from email to word processing and spreadsheets. Specialized applications like Flickr and YouTube provide options for hosting and sharing media; tools for creating multimedia projects like Prezi (http://www.prezi.com) and Vuvox (http://www.vuvox.com) live in the cloud. There is no single computer, or even specific group of computers, that can be pointed to as housing these applications. 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 is key.

The cloud does have certain drawbacks. Unlike traditional software packages that can be installed on a local computer and are available as long as the operating system supports them, cloud-based applications are services offered by companies and service providers in real time. Entrusting your work and data to the cloud is also a commitment of trust that the service provider will continue to be there, even in face of changing market and other conditions. Nonetheless, the economics of cloud computing are increasingly compelling. For many institutions, cloud computing offers a cost-effective solution to the problem of how to provide services, data storage,

and computing power to a growing number of Internet users without investing capital in physical machines that need to be maintained and upgraded on-site.

Relevance for Teaching, Learning, or Creative Expression

The emergence of cloud-based applications is causing a shift in the way we think about how we use software and store our files. The idea of data storage as something that can be separated from an individual computer is not unusual, but now it is becoming common to consider applications in the same light. Instead of locking files and software inside a single computer, we are gradually moving both the products of our work and the tools we use to accomplish it into the cloud. Once there, applications and data are both accessible from any computer, using tools that are free or very inexpensive. Because they live on the network, applications in the cloud make it easy to share documents, collaboratively edit, and effectively manage versions.

Cloud-based applications can provide students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools. Schools are beginning to take advantage of ready-made applications hosted on a dynamic, ever-expanding cloud that enable end users to perform tasks that have traditionally required site licensing, installation, and maintenance of individual software packages. Email, word processing, spreadsheets, presentations, collaboration, media editing, and more can all be done inside a web browser, while the software and files are housed in the cloud.

In addition to productivity applications, services like Flickr, YouTube, and Blogger (http://www.blogger.com), 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. Applications like Splashup (http://www.splashup.com) or JayCut (http://www.jaycut.com) make it easy for students to experiment with photo and video editing. With tools like SlideShare (http://www.slideshare.net) or SlideRocket (http://www.

sliderocket.com), they can publish presentations and slide shows. Further, it is very easy to share content created with these tools, both in terms of collaborating on its creation and distributing the finished work.

Browser-based applications are accessible for a variety of computer and even mobile platforms, making these tools available anywhere the Internet can be accessed. Already, cloud-based applications are being used in schools to provide virtual computers to students and staff without requiring each person to own the latest laptop or desktop machine; a handful of basic machines, provided they can access the Internet and support a web browser, are all that is needed for access to virtually unlimited data storage and programs of all kinds.

We are just beginning to see direct applications for teaching and learning other than the simple availability of platform-independent tools and scalable data storage. This set of technologies has clear potential to distribute applications across a wider set of devices and greatly reduce the overall cost of computing. The support for group work and collaboration at a distance embedded in many cloud-based applications could be a benefit applicable to many learning situations.

A sampling of applications of cloud computing across the curriculum includes the following:

- **Geography** Students can study real-time, real-world data with tools like Earthbrowser (http://www.earthbrowser.com). Earthbrowser combines a desktop interface with the data storage and computing power available in the cloud to create an interactive map populated with weather, geological, and other data.

- **Social Studies** Using cloud-based visualization tools like GapMinder World (http://graphs.gapminder.org/world), students can explore statistical information about income, health, life expectancy, fertility rates, natural resources, and more in a visual, interactive way.

- **Science** Students in chemistry, physics, astronomy, biology, and computing use Socratica

(http://socratica.com), a "classroom in the cloud," to access — and create — study modules. Teachers can add modules as well, creating a growing, open resource that is available free of charge.

Cloud Computing in Practice

The following examples provide snapshots of how cloud computing is being applied in practice.

CloudTrip: Education
http://www.cloudtrip.com/index.php?category=Education

CloudTrip is a fledgling directory of cloud-based applications, sorted into categories. The Education listing includes applications for testing, student portfolios, digital storytelling, and more.

North Carolina School Takes to the Clouds with Virtual Desktops
http://www.thejournal.com/articles/23377/

A partnership between SimTone Corporation and Frank Porter Graham Elementary School in Chapel Hill, North Carolina, will leverage cloud computing technologies to provide students and staff with virtual computers.

Open Science Grid
http://www.news.wisc.edu/12927

The University of Wisconsin-Madison and several partner schools are working on a project to develop and expand a national Open Science Grid to provide computing power and data storage to solve large, data-intensive challenges in science.

Science Clouds
http://workspace.globus.org/clouds/

Science Clouds provides cloud computing resources to scientists in support of specific projects. Scientists may request time on the clouds in exchange for a short write-up of their project.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about cloud computing.

How Cloud Computing is Changing the World
http://www.businessweek.com/technology/content/aug2008/tc2008082_445669.htm

(Rachael King, BusinessWeek, 4 August 2008.) This article describes a perceived shift in the way we think about computing as more companies begin to use cloud-based applications for communications and productivity tasks.

The Cloudworker's Creed
http://www.ribbonfarm.com/2008/10/23/the-cloudworkers-creed/

(Venkatesh Rao, Ribbonfarm.Com, 23 October 2008.) This blog post introduces the concept of a cloudworker, the information professional of tomorrow.

Google Gears = No More Office/OpenOffice for Students
http://education.zdnet.com/?p=2052&tag=nl.e623

(Christopher Dawson, ZDNet Education, 26 January 2009.) Google Gears synchronizes offline and online versions of blogs and documents so that authors can edit offline, where drafts are saved locally until an Internet connection is present. This article discusses some of the implications.

Use of Cloud Computing Applications and Services
http://www.pewinternet.org/PPF/r/262/report_display.asp

(John Horrigan, Pew Internet & American Life Project, 12 September 2008.) This data memo reports on the number of Internet users who are making use of cloud-based applications and services and reviews their expressed preferences.

Delicious: Cloud Computing
http://delicious.com/tag/hzk09+cloudcomputing

(Tagged by K-12 Horizon Advisory Board and friends, 2009.) Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report*. To add to this list, simply tag resources with "hzk09" and "cloudcomputing" when you save them to *Delicious*.

SMART OBJECTS

Time-to-Adoption Horizon: Four to Five Years

Smart objects link the virtual world and the real: a smart object "knows" about itself and its environment, and can reveal what it is for, who owns it, where and how it was made, and what other objects in the world are like it. A smart object can be tied to related information in a variety of media, placing itself within a rich context that is made plain simply by following the connection. Smart objects can interact with one another, creating new interfaces for controlling computers. There are many technologies that support smart objects, from simple printed stickers to complex computing and sensor networks. In each case, whatever the underlying technology, smart objects exist in the physical world but have some kind of virtual counterpart. The means to create, track, and use smart objects has not yet entered the mainstream, but recent advances in identification technology have led to some interesting proof-of-concept applications that suggest everyday uses are just down the road.

Overview

In the simplest sense, a smart object is any physical object that includes a unique identifier that can track information about the object. More complex smart objects may contain sensors and computers in addition to a unique identifier, but the sensor and the computer may also be separate tools that interact with a tagged object that has no electronic components. Radio-frequency identification (RFID) tags and quick response (QR) codes can be attached to everyday things to turn them into smart objects, as can other means of identification like those that make smartcards work. More sophisticated smart objects may look like blocks but contain computers and the ability to sense position, proximity to other smart objects, light, heat, color, and so on.

Smart objects have been in use for point-of-sale purchases, passport tracking, inventory management, identification, and similar applications for quite some time. RFID tags and smartcards "know" how much money is in a user's account, how to transfer the correct amount to a retailer, how to deduct one trip through a toll booth from a driver's monthly pass, which book is being checked out from a library, whether that patron currently has any overdue books, and so on. QR codes can be generated online, printed out, and attached to posters, telephone poles, t-shirts, and other everyday objects; once there, they can be read by camera-enabled mobiles to call up a host of information about the tagged object. Small household

appliances can contain smart chips that recognize their location and can call up local information about weather conditions, traffic patterns, and the like.

Whatever the technology that makes a smart object smart, the thing that makes it interesting is how it connects the physical world with the world of information. A smart object carries with it much more information than is obvious to the eye: smart objects can be used to digitally manage physical things, to track them throughout their lifespan, and to annotate them with descriptions, opinions, instructions, warranties, tutorials, photographs, and any other kind of contextual information imaginable. Smart objects that can be used to control computers are beginning to enter the market, opening the door to a range of new interfaces shaped like everyday objects.

Web services like ShotCode (http://www.shotcode. com) and Kaywa (http://qrcode.kaywa.com/) let anyone encode QR tags and print them out; they can be placed on business cards, postcards, flyers, apparel, product tags, or anything else that can be printed. Anyone with a camera-enabled cell phone can take a photo of the tag, analyze it, and decode the information, which could be a URL, an address, a phone number, or something similar. Taking smart objects a step further, products like Tikitag (http://www.tikitag.com) and Violet's Mir:ror (http://www.violet.net) make it easy and fun to attach scannable stickers to household objects. When the object

is placed on or near a USB scanner attached to a personal computer, the tag is read and the computer performs whatever actions the user has associated with that particular tag, like launching a game or other application, or playing a certain music playlist.

Emerging products like Siftables (http://www.siftables.com) combine the sensor and computer inside the smart object. Siftables are small, blocklike smart objects that include a display and the ability to sense their own location and orientation and the proximity of other Siftables; they can play music, form words, and perform other actions, creating in effect a computer interface that is made of building blocks. Poken (http://www.doyoupoken.com) are small USB devices that can interact with one another to transmit and store a user profile. Poken owners who meet in person simply touch their poken together to exchange friend information on social networks they belong to, like Facebook or MySpace. Later, the new contacts are updated by connecting the poken to the owner's computer.

Simple applications like these represent very early uses of smart objects in everyday life, and are significant because they are user-friendly and do not require a great deal of capital outlay or technological expertise. Future applications of smart object technology may further blur the distinction between physical objects and digital information. Sensors and computers embedded in objects all around us may change our concept of what a computer is: instead of a box under the desk, a computer may be *all* the objects on the desk.

Relevance for Teaching, Learning, or Creative Expression

Although smart objects have been in use in business and industry for some time, it is only recently that it has become easy and cheap for students and teachers to create and use QR tags and smartcode stickers, or to acquire user-friendly smart objects with embedded sensors. Products like Poken, Siftables, and Tikitags are making smart objects approachable and appealing, which is likely to impact their adoption by young people and teachers.

LEGO Mindstorms (http://mindstorms.lego.com) have been available for several years. Mindstorms kits combine LEGO bricks with sensors and a small, programmable computer "brain" to allow builders to create smart sculptures that can sense light, color, and motion and perform programmed actions in response. Other developing products, such as Siftables, may turn out to have applications for education: Siftables can contain numbers or letters and can parse mathematical operations and dictionary lists, so students can use them to practice math or spelling drillwork. Teachers are also experimenting with using QR codes to deliver homework assignments, or asking students to use QR codes in class projects.

Libraries are an obvious place where smart objects come in handy, and not only for obvious purposes like collection tracking and checking materials in and out. Some libraries are investigating further applications of smart objects: a project called ThinkeringSpaces from the Illinois Institute of Technology's Institute of Design (http://www.id.iit.edu/ThinkeringSpaces/) combines physical and virtual components to produce an environment where physical objects, like books, can be annotated with contextual information that is added manually or retrieved automatically. The information remains connected with the object and displays whenever the object is scanned, so that when a patron places a book on the reader, he or she can watch a recorded interview with the author, call up other readers' reviews, or leave a review of his or her own.

Smart objects do not have to be located in the classroom to be useful. The CENSEI project at the University of California, Los Angeles (http://censei.ucla.edu) aims to develop curricular units built around data collected from remote sensor networks; smart objects placed in the field track climate and weather changes, monitor water conditions, and take other measurements that can be used in science classes. The units are aimed at middle-school students in California.

Semapedia (http://semapedia.org), a collaborative project that aims to connect tagged physical objects with online information in Wikipedia using QR codes, suggests another potential use for smart objects in the classroom. Students can create QR codes that link to Wikipedia entries for local landmarks or areas of interest, print them out, and attach them on-site to provide visitors with additional information.

A sampling of applications for smart objects across the curriculum includes the following:

- **Social Studies** Students examining tagged cultural objects brought into the classroom could use handheld devices like the iPod Touch to call up a wealth of information, including photographs, maps, video and audio recordings, related to the object they are holding.

- **Local History** A school- or community-wide scavenger hunt might make use of QR codes or other smart tags to offer clues for participants and direct them to certain locations. Combined with links to online information, the clues could introduce students to historical events that took place in the vicinity.

- **Electronics** In Philadelphia, community classes for young people and adults use pre-packaged kits and the open-source Arduino platform to teach basic electronics concepts. Students bring a laptop to class, but everything else is provided for them to make experimental objects that can sense environmental conditions.

Smart Objects in Practice

The following examples provide snapshots of how smart objects are being applied in a variety of contexts.

Arduino
http://www.arduino.cc/

Arduino is an open-source electronics prototyping platform that allows users to create objects that can sense and respond to the environment.

iPhone in Education: Using QR Codes in the Classroom
http://olliebray.typepad.com/olliebraycom/2008/11/iphone-in-education-using-qr-code-in-the-classroom.html

(Ollie Bray, OllieBray.com, 24 November 2008.) The author explains and demonstrates a way to use QR codes to convey homework assignments to students.

LeapFrog Tag
http://www.leapfrog.com/tag/

The Tag by LeapFrog, aimed at very young children, is a pen-shaped device that allows kids to interact with specially printed books and other materials. Children listen to the story, hear words pronounced, and play games by tapping the pen on the pages.

Siftables
http://siftables.com/

Watch the 7-minute video to see an overview and demonstration of Siftables including clips of children using them to play word games and to create an interactive, illustrated story.

UW Team Researches a Future Filled with RFID Chips
http://seattletimes.nwsource.com/html/businesstechnology/2004316708_rfid31.html

(Kristi Heim, The Seattle Times, 31 March 2008.) Researchers at the University of Washington are exploring the positive and negative aspects of using RFID tags to track the movements of people in a social setting — by tracking themselves.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about smart objects.

High Five the Panda to Connect Online

http://springwise.com/lifestyle_leisure/poken_ high-five_the_panda_to_c/

(Jochem de Swart, Springwise.com, 2 February 2009.) This article describes Pokens, small USB devices that can swap social networking information in face-to-face interactions.

Internetting Every Thing, Everywhere, All the Time

http://edition.cnn.com/2008/TECH/11/02/ digitalbiz.rfid/

(Cherise Fong, CNN.com/technology DigitalBiz, November 2008.) This article describes the Internet of things and illustrates some current examples of smart object technology.

The Net Shapes Up to Get Physical

http://www.guardian.co.uk/technology/2008/ oct/16/internet-of-things-ipv6

(Sean Dodson, Guardian.co.uk, October 2008.) This article describes the Internet of things and discusses the technologies involved, as well as considering potential applications for networked smart objects.

Thinkering Spaces in Libraries

http://theshiftedlibrarian.com/archives/2008/ 06/17/thinkering-spaces-in-libraries.html

(Jenny Levine, The Shifted Librarian, 17 June 2008.) This post, and the two that follow it, describe the library demonstration of ThinkeringSpaces as seen by the author.

Touch

http://www.nearfield.org/about

Touch is a research project at the Oslo School of Architecture and Design that is investigating the potential of near-field communication (NFC), a standard based on RFID and now being embedded in mobiles, for touch interactions with physical objects.

Delicious: Smart Objects

http://delicious.com/tag/hzk09+smartobject

(Tagged by K-12 Horizon Advisory Board and friends, 2009.) Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hzk09" and "smartobject" when you save them to *Delicious.*

THE PERSONAL WEB

Time-to-Adoption Horizon: Four to Five Years

Teachers using the Internet as a resource are as aware as anyone else that the amount of content available on the web is staggering. Selecting valuable material to use in preparing lessons or to suggest as resources for students is a time-consuming and sometimes frustrating task. The proliferation of content — both useful and not — has been fueled in part by the ease of web publishing; it is easy to blog, tweet, post photos and videos, comment on other blogs, create course websites, and post updates to social networks online. Another issue goes hand-in-hand with the question of how to find useful material: the problem of how to keep track of the various bits of content posted by colleagues, peers, friends, or even oneself. To deal with these issues, readers and publishers of online content are assembling collections of tools, widgets, and services that handle developing and organizing dynamic online content. Tools for tagging, aggregating, updating, and keeping track of content assist today's learners in creating and navigating a web that is increasingly tailored to their own needs and interests: the personal web.

Overview

The personal web refers to both a collection of technologies and a way of thinking about online content. Described in the *2009 Horizon Report* as part of a trend that began with simple innovations like personalized start pages, RSS aggregation, and customizable widgets, the personal web is a term coined to represent a collection of technologies that confer the ability to reorganize, configure and manage online content rather than just viewing it; but part of the personal web is the underlying idea that web content can be sorted, displayed, and even built upon according to an individual's personal needs and interests.

Simple tools to create customized, personal web-based environments to support social and academic activities are easily available today, but their use in schools is severely hampered by access and filtering policies. Tools that foster personal and social forms of learning and expression, though technically unrelated, work together seamlessly without any need for complicated setup, thanks to open applications programming interfaces (APIs) and easily integrated web feeds. Teachers are beginning to see how they can easily create online spaces for their classes that contain just the information they want their students to see. Students can create — and work in — online spaces that reflect their own

interests and studies. The vast collection of content that makes up the web can be tamed, filtered, and organized, and anyone can publish as much or as little as they wish. Increasingly outside of school, the web experience is a personal one, tailored to the needs of the user; as schools become more open to the techniques and toolsets, it will move into learning environments as well.

The challenges that relate to this set of technologies are primarily in the policy arena, and that is why it has been placed on the far horizon. This is not a reflection of the state of the technology; as noted above, the tools to facilitate the types of activities that take place around the personal web are here, readily available, today. In fact, the underlying technology that supports the web has all but vanished for most users; all that is necessary is to know which tools to use, and any task — from creating and distributing class materials, to organizing group work and team tasks, to developing a library of resources that constantly refresh and update themselves — becomes point-and-click trivial.

Policy decisions designed to protect students from encountering potentially harmful content also limit access to valuable educational content. Inadequate infrastructure and equipment also restrict access; in classrooms where there is a single computer, or in

schools where students can only use computers in libraries or labs, there is little opportunity for students to curate or maintain evolving collections of online material.

There is good news. As more teachers demonstrate the value of online collaborative environments and communication tools, and as more students create blogs, develop photo and video journals, and participate in social networks, policy may gradually change. As the value of providing Internet access to students becomes more clear, infrastructure issues will be addressed, and the personal web will be an accessible tool for students.

Relevance for Teaching, Learning, or Creative Expression

The tools of the personal web are ideal for research and learning. Teachers and students can tag, categorize, publish, and review work online quickly and easily, without the need to understand or even touch the underlying technologies. Rich, personal resource collections can be set up using tags and web feeds; they can be searched, annotated, and tailored to support any interest or subject. Delicious (http://delicious.com) and Diigo (http://www.diigo.com) organize web links according to subject. Viewers saving the links apply descriptive tags that can later be searched or browsed. While this is not a new concept, tagging online resources has become a common strategy among researchers. (Indeed, it is a key strategy used in producing this report!)

Browser widgets — small tools that can be installed easily, often by simply dragging to the browser toolbar — extend the functions of web browsers in dramatic ways. One example, Zotero (http://www.zotero.org), is a reference tool that keeps bibliographic notes, summaries, and reader notes for web materials in much the same way an index card would, and Zotero also stores a link to the resource. Using resources like Zotero, Diigo, and Delicious, students can create a kind of personal online card catalog to support their studies.

On the publishing side, students can use blogging tools to set up multimedia journals. Many photo and video sharing sites like Flickr, Picasa, YouTube, and Google Video let authors embed media into their blogs with a single click. Microblogging, the practice of posting brief updates to services like Twitter, Facebook, and others, is another way for students to reach out to peers and experts, or share their ideas about what they are learning or doing. Widgets for cross-posting updates so that a statement entered on one service appears on many others automatically extend the audience, and a variety of tools are available for following the updates of others. The ease of online publishing, especially blogging, gives students a place to voice their opinions, ideas, and research.

With all the options that are available for publishing content, it can be difficult for teachers to keep track of student work, or for students to keep up with what their peers are publishing. Tagging is one method, as mentioned above; but tagging is time-consuming and relies on content being tagged with the same terms one uses to search. Aggregators are an easier way to collect and display content. Using web feeds, tools like Tumblr (http://www.tumblr.com) and Posterous (http://www.posterous.com) pull bits of content together in a single place where updates appear automatically. Students can use these tools to gather their work into an online portfolio; whenever they add a tweet, blog post, photo, or video to any online service they subscribe to, it will appear in their timeline. A teacher might create a profile for his or her class to share; anyone in the class could then add content to a single feed that would update whenever new material is posted.

A sampling of applications of the personal web across the curriculum includes the following:

- **Student Research** Using a custom social networking application like Elgg (http://elgg.org), teachers can create a class- or school-wide student network where research links, discussions, notes, media files, and other information can be shared in a protected environment.

- **Global Collaboration** Middle school students in Manitoba, Canada and their peers in South Africa support their learning with an "idea hive," a loosely-coupled collection of personal tools to share photos, videos, blog posts, and other selected content (see http://remoteaccess. typepad.com).

- **Reading** A North Carolina teacher allowed her students to select from a list of online texts, then asked them to take notes on the texts using Diigo to demonstrate their mastery of reading strategies practiced in class (see http://isenet. ning.com/profiles/blogs/diigo-with-a-twist-reading).

The Personal Web in Practice

The following examples provide snapshots of how the personal web is being applied in a variety of contexts.

eTwinning
http://www.etwinning.net

This website provides an easy way for European schools to collaborate, define projects, have an online workspace, and collect their resources in one spot. The schools form partnerships with schools in other countries around shared projects.

Media Master: TransMedia Mapping
http://www.globalkids.org/?id=22

In the Global Kids Media Master Program, students select a human rights issue and research it in blog posts, newspaper articles, photos, videos and books. Using the Google MyMaps customizable mapping tools, the students create a multimedia map using the sources they have found, adding comments as to why each piece of content is relevant to the issue.

Omeka
http://omeka.org

Omeka is a free, open source, collections-based web publishing platform for teachers, scholars, librarians, archivists, museum professionals, and cultural enthusiasts. Built and maintained by the Center for New Media and History at George Mason University, Omeka is a robust publishing tool for creating online resources.

SmARThistory
http://smarthistory.org

SmARThistory is an edited online art history resource to augment or replace traditional art history texts. For a given artwork, smARThistory brings together podcasts, video clips, images, links to other resources, and commentary, providing a rich context for the work.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about the personal web.

The Art & Technique of Personal Learning Networks
http://bit.ly/david-warlick-pln

This workshop by David Warlick is designed to help K-12 educators learn how to build and sustain their own personal learning networks.

The Evolution of Personal Publishing
http://www.readwriteweb.com/archives/the_evolution_of_personal_publ.php

(Alex Iskold, ReadWriteWeb, December 2007.) This post traces different categories of personal publishing – blogs, social networks, and microblogs – and posits that each appeals to a different type of writer and fills a particular purpose in social publishing.

Personal Learning Environment Diagrams

http://edtechpost.wikispaces.com/PLE+Diagrams

> *(Scott Leslie, EdTechPost, 2008.)* The author has collected visual representations of various descriptions of personal learning environments, displaying them on a wiki page.

A Widget Onto the Future

http://www.insidehighered.com/news/2008/12/08/widgets

> *(Andy Guess, Inside Higher Ed, 8 December 2008.)* This article describes widgets — tools for personalizing the information on a website — and provides examples of some developed expressly for education.

***Delicious:* The Personal Web**

http://delicious.com/tag/hzk09+personalweb

> *(Tagged by K-12 Horizon Advisory Board and friends, 2009.)* Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hzk09" and "personalweb" when you save them to *Delicious.*

METHODOLOGY

The process used to research and create the *Horizon Report: 2009 K-12 Edition* is very much rooted in the methods used to develop the global edition of the *Horizon Report* that is released each January. All editions of the *Horizon Report* are produced using a carefully constructed process that is informed by both primary and secondary research. Nearly a hundred technologies, as well as dozens of meaningful trends and challenges are examined for possible inclusion in the report for each edition. Every report draws on the considerable expertise of an internationally renowned Advisory Board that first generates a broad set of important emerging technologies, challenges, and trends, and then examines each of them in progressively more detail, reducing the set until the final listing of technologies, trends, and challenges is selected.

Much of the process takes place online, but when new editions are created for the first time, a face-to-face meeting is often also part of the process, as a way to quickly build an engaged community among the advisors. All the work, wherever it occurs, is captured and placed in the Horizon Project wiki, which is the project's home on the web. The Horizon wiki is intended to be a completely transparent window to the process, and contains the entire record of the research. The wiki for the *K-12 Edition* can be found at http://horizon.nmc.org/k12.

The procedure for selecting the topics that will be in the report includes a modified Delphi process now refined over years of producing *Horizon Reports,* and it begins with the assembly of the Advisory Board. The board as a whole is intended to represent a wide range of backgrounds, nationalities, and interests, yet each member brings a particularly relevant expertise. To date, more than 275 internationally recognized practitioners and experts have participated in a Horizon Project Advisory Board; in any given year, as many as half the members are new.

Once the Advisory Board for a particular edition is constituted, their work begins with a systematic review of the literature — press clippings, reports, essays, and other materials — that pertains to emerging technology. Advisory Board members are provided with an extensive set of background materials when the project begins, and are then asked to comment on them, identify those that seem especially worthwhile, and add to the set. The group discusses existing applications of emerging technology and brainstorms new ones. A key criterion for the inclusion of a topic is the potential relevance of the topic to teaching, learning, research, or creative expression. A carefully selected set of RSS feeds from at least a dozen relevant publications ensures that these background resources stay current as the project progresses, and they are used to inform the thinking of the participants throughout the process.

Following the review of the literature, the K-12 Advisory Board engaged in the central focus of the research — the five research questions that are at the core of the Horizon Project. These questions were designed to elicit a comprehensive listing of interesting technologies, challenges, and trends from the Advisory Board:

1 *What would you list among the established technologies that schools should all be using broadly today to support or enhance teaching, learning, or creative expression?*

2 *What technologies that have a solid user base in consumer, entertainment, or other industries should schools be actively looking for ways to apply?*

3 *What are the key emerging technologies you see developing to the point that schools should begin to take notice during the next three to five years? What organizations or companies are the leaders in these technologies?*

4 *What do you see as the key challenges related to teaching, learning, or creative expression that schools will face during the next five years?*

5 *What trends do you expect to have a significant impact on the ways in which schools approach our core missions of teaching, research, and service?*

One of the Advisory Board's most important tasks is to answer these five questions as systematically and broadly as possible, so as to generate a large number of potential topics to consider. To help with this, past *Horizon Reports* are revisited and the Advisory Board is asked to comment on the current state of technologies, challenges, and trends identified in previous years, and to look for metatrends that that may be evident only across the results of multiple years.

At this point, the Advisory Board is asked to generate as many new responses to the questions as possible, and also to comment on the existing responses. The regional and sector-based reports add one additional step as a way to seed the responses: the topics from the short lists of the global and other regional editions for the current year are included in the list of topics to consider. Once this work is done, usually within just a few days, the Advisory Board moves to a unique consensus-building process that uses an iterative Delphi-based methodology.

In the first step of this approach, the responses to the research questions are systematically ranked and placed into adoption horizons by each Advisory Board member using a multi-vote system that allows members to weight their selections. Each member is asked to also identify the timeframe during which they feel the technology would enter mainstream use

— defined for the purpose of the project as about 20% of institutions adopting it within the period discussed. (This figure is based on the research of Geoffrey A. Moore and refers to the critical mass of adoptions needed for a technology to have a chance of entering broad use.) These rankings are compiled into a collective set of responses, and inevitably, the ones around which there is the most agreement are quickly apparent.

From the more than 100 technologies originally considered for any report, the twelve that emerge at the top of the initial ranking process — four per adoption horizon — are further researched. Once this "short list" is identified, the group, working with both NMC staff and practitioners in the field, begins to explore the ways in which these twelve important technologies might be used in for teaching, learning, research, and/or creative expression. A significant amount of time is spent researching real and potential applications for each of the areas that would be of interest to practitioners.

For every edition, when that work is done, each of these twelve "short list" items is written up in the format of the *Horizon Report.* With the benefit of the full picture of how the topic will look in the report, the "short list" is then ranked yet again, this time in reverse. The six technologies and applications that emerge are those detailed in the *Horizon Report.*

For additional detail on the project methodology or to review the actual instrumentation, the ranking, and the interim products behind the report, please visit http://horizon.nmc.org/k12.

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