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Overview

This bulletin provides an overview of the current state of mobile learning in higher education, speculates on future directions, and suggests questions that educators might ask of themselves and their institutions in preparation for the onset of mobile education. Ignoring mobile learning is not an option when it has already begun to show a strong potential to disrupt existing pedagogical infrastructure, including that of online education. It is up to those in higher education to adapt this freewheeling trend to best serve the core mission of educating students.

What Is Mobile Learning?

Mobile learning has been variously defined as “learning by means of wireless technological devices that can be pocketed and utilized wherever the learner’s device is able to receive unbroken transmission signals,”¹ “learning supported by mobile devices such as cellular (mobile) phones, portable computers, and personal audio players,”² and “any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies.”³

The *mobility* of mobile learning—an essential defining attribute—is beyond dispute, but the set of devices that are included in any definition of the field necessarily changes over time. Arguably, today’s definition has narrowed to specify handheld devices only: mobile phones (in particular but not exclusively smartphones); PDAs (do they still exist?); audio players; and the newest entrant, tablets. Laptops and netbooks are technically not included⁴—they’re not handheld, and they belong to the set of devices that employ the desktop WIMP (window, icon, menu, pointing device) computing metaphor, rather than the handheld NUI (natural user interface) metaphor.

Mobile learning allows participants to break free of the classroom, but distance learning already accomplished that. Mobile learning allows a further breakout, untethering learners from their desks, from their dwellings, from buildings altogether. Learning can occur anywhere and, in this sense, has become truly ubiquitous. It can occur “wherever people, individually or collectively, have problems to solve or knowledge to share.”⁵ Portions of life once considered inaccessible to learning due to lack of network connectivity are now potential learning opportunities for the mobile learner.

Students value anytime, anywhere access to the Internet. In the most recent ECAR study of students and IT, 78% of students considered Wi-Fi extremely valuable to their academic success.⁶ While a wireless telecommunications network is obviously preferable because it allows interaction, updates, hyperlinks, and more, it is still not ubiquitous. The ECAR research report *Mobile IT in Higher Education, 2011* found that 76% of institutions report good or very good mobile communication signal coverage in the area of our institution.⁷ This is a positive trend for on-campus mobile learning; however, off-campus access to networks is important as well.

Highlights

As devices become more personal, so does learning. Mobile learning is personalized, learner-centered, situated, collaborative, ubiquitous, and contextual.⁸ Now that we know what mobile learning is, what does it look like? Who is using it? Where can we see examples of it?

Mobile Learning Today

Stand-alone mobile learning applications are proliferating at an astonishing rate: As of September 2011, the iTunes App store offered 46,340 apps in the education category, accounting for 9.35% of all apps available;⁹ as of October 2011, the total number of education apps for the Android platform (available from the Android Market) was 12,129.¹⁰

Established e-learning systems have evolved to offer mobile components, fostering anytime, anywhere access to coursework. Blackboard Mobile is a mobile interface for the Blackboard learning management system that runs on iPad, iPhone, Android, BlackBerry, and WebOS mobile devices.¹¹

Colleges and universities are jumping on the mobile learning app bandwagon. According to the ECAR research report on mobile IT, 53% of colleges and universities had mobile-enabled at least one service, application, or website in the previous year.¹² Similarly, a 2011 U.S. survey by the Campus Computing Project showed that 55.3% of public universities, 43.6% of public colleges, and 40.9% of community colleges have activated mobile apps as of fall 2011. In the private higher education sector, 50.0% of universities and 25.2% of colleges have deployed mobile apps. The combination of students' expectations, increased availability of mobile front-ends to traditional LMS systems, and the proliferation of free apps has contributed to this trend.¹³ The ECAR 2011 study on students and IT found that more than half of undergraduates own smartphones and about two in five (37%) use them to supplement their academic work. One-third of students said that smartphones are "extremely valuable for academic success."¹⁴

Outside the United States, mobile learning is growing by leaps and bounds. The U.K. MoLeNET program, "possibly the world's largest and most diverse implementation of mobile learning," fueled by more than \$25 million in funding by government and academia, involves upwards of 40,000 learners in 104 different projects involving 147 colleges and 37 schools.¹⁵

In the United Kingdom, another mobile learning project called MyArtSpace provided children on school trips to museums and galleries with mobile phones running apps linking multimedia content with the exhibits they were attending. The students could take photos, record themselves speaking, and enter notes, which the app then relayed to a website that students could share upon returning to their classrooms.¹⁶

Technological Enablers

From Australia to Peru to Belgium, mobile learning projects are proliferating. In developing regions, mobile learning far outpaces desktop-based e-learning, aided by the increasing presence of faster telecommunication networks and cheap smartphones.¹⁷

Advances in mobile technology—both networks and devices—and saturation levels of mobile usage will drive future trends in mobile learning:

- Mobile networks are currently accessible to upwards of 90% of the world's population.¹⁸
- There are currently 5.3 billion mobile subscribers worldwide, which is 77% of the world's population.

- Within five years, 1 billion people worldwide are expected to access the Internet via their mobile devices. This mode of access will surpass that of the personal computer in that time frame.¹⁹

Wireless communication networks are moving to broadband capabilities with 3G and now 4G protocols coming online:

- 4G networks promise up to 1 GB per second transfer speed for walking or stationary pedestrian usage.²⁰
- 4G wireless began rollouts in the United States in late 2010, and by 2015 the United States will have the largest 4G coverage in the world.²¹

The power of mobile devices is growing along with that of the networks:

- Phone CPUs, the chips that power mobile computing, have recently reached the 1 GHz speed, comparable to netbooks.
- Many smartphones have accelerometers (sensors that switch the display from landscape to portrait depending on the orientation), gyroscopes, compasses, and GPS capabilities that facilitate exact location and orientation of the devices.²²

With a critical mass of network capabilities, device hardware and software power and versatility, and global membership, mobile learning is poised to alter the educational ecosystem in significant ways.

Possible Futures of Mobile Learning

Based on what we know today, developments in mobile learning indicate that future capabilities are likely to trend in the following directions.

Location-based learning. GPS-enabled devices facilitate applications and interactions that incorporate the learner's location. Learners can be location-tracked in relation to other learners, thus facilitating interaction. Awareness of location enables delivery of geographically relevant information and just-in-time pedagogy as learners encounter natural and artificial landmarks created for pedagogical purposes. Learners can annotate location with programs like Mscape, creating "mediascapes" that other learners can consume and further annotate. Alternatively, learners can draw from existing databases of location-aware information: "Using tools like WikiMe (<http://www.whatsoniphone.com/reviews/wikime-review>), an application for the iPhone that accesses relevant Wikipedia articles for a specific location using the GPS in a mobile device, students can find information about their physical location or research other places using postal codes."²³

Augmented reality. Augmented reality (AR) is a technology that merges visual perception of real-world environments and objects with virtual, computer-generated content. This is achieved by overlaying a camera-mediated viewpoint with virtual objects and displaying the result via specially engineered glasses or, more commonly, smartphone displays.

AR applications grow more sophisticated each year. Early pioneers in the AR movement foresaw their discipline being largely realized in head-mounted devices and augmented glasses. So far this has not been realized on a large scale, as the rapid development of smartphones with camera and display technologies has made AR much more feasible on these devices. For example, Layar, perhaps the most popular AR application for smartphones, allows users to overlay graphics and animations on scenes, post location-specific messages or tweets, and share these with other Layar users traversing the same or nearby locations.²⁴

AR builds on the capabilities of location-based learning, adding an extra perceptual layer that brings learning into a new realm of immersive interaction. Possible future applications of AR in mobile learning include:

- Presence of avatars from virtual worlds superimposed on real-world locations. Picture an avatar of a subject-matter expert strolling alongside the learner, pointing out sites of interest and explaining in-depth cultural, scientific, and historical aspects of the learner's location.
- Location-based annotation (geotagging) that will enable teachers and learners to annotate the world, precipitating an ongoing global conversation dispersed across myriad locations of interest.
- Historical overlays that show the learner's location altered to simulate previous historical epochs or, alternatively, to speculate about future conditions.
- X-ray vision (of a sort) that allows learners to peer inside landscape features, buildings, artifacts, and anything else that has an interior that can be visualized and virtualized using computer imaging.
- Game overlays that project gaming artifacts and environmental enhancements into a scene, facilitating interactive learning in a gaming mode.
- Treasure hunts employing virtual objects placed in various real-world locations that learners using AR hardware and software can seek out and interact with.

This is merely the tip of the iceberg in terms of what future location-based and AR-enhanced mobile learning applications might hold in store. As mobile devices themselves evolve, we could see any of the following:

Wearable learning. One aspect of wearable computing that can enhance situational awareness on many levels is sensor arrays. The wearer's clothing can be studded with sensors that detect sensory-level environmental data that supplement the wearer's awareness by recording and playback of auditory and visual stimuli that the wearer may not have been focused on. The sensors could also gather inputs that are beyond human sensory capabilities, such as radiation levels, subsonic waves, local gravity fields (gravitometer), and electromagnetic fields. Wearable sensors can also provide sensory capabilities to the sensory impaired, allowing for in situ experiences and learning that might not have been possible otherwise.²⁵

Learning implants. The logical evolution from portable to wearable to implanted computing capabilities proceeds apace. While most research and experimentation with brain-computer interfaces focuses on neuroprosthesis-related applications, general-use brain implants intended as gaming interfaces are being developed.²⁶

Ambient intelligence. *Ambient intelligence* is a broad term describing the convergence of ubiquitous high-speed wireless communication and the Internet of Things, the latter being the ability to assign an Internet address to virtually every object on earth (made capable by IPv6, the next-generation communications protocol for the Internet). If those objects are endowed with computing power, computation and intelligence become ubiquitous and ambient.²⁷ Mobile learning will encounter a world where "the environment has become the interface,"²⁸ where knowledge building and intelligence amplification have become like breathing.

What It Means to Higher Education

Mobile learning extends the reach of technology-mediated pedagogy but offers more. Location-aware applications, networked cohorts untethered from desks and keyboards, and anywhere, anytime learning are both new and old. The peripatetic knowledge seekers of ancient Greece might be an interesting jumping-off point for modeling mobile apps; their accomplishments poured the foundations of western civilization.

While higher education institutions are adapting mobile learning apps at a brisk pace, fully embracing the pedagogical implications of mobile learning could conceivably contribute to the decline of those institutions as bastions of knowledge acquisition. This form of learning is mobile from the outset and is, by definition, already largely untethered from the constraints of traditional pedagogical infrastructure.

Rather than imposing legacy pedagogical guidelines on mobile learning, higher education decision makers, instructional designers, and, perhaps most importantly, teachers need to innovate, experiment, and be prepared to fail. It's not clear where mobile learning technology and applications will go, but as the factors set forth in this bulletin suggest, it will be disruptive, explosive, and game changing when it hits its stride.

Key Questions to Ask

- How can we stay relevant in a world of mobile education? Will embracing mobile learning make our institution obsolete? Conversely, can we afford to stand on the sidelines as mobile learning takes off across all of higher education?
- How does mobile learning fit into our curriculum, and how well are we prepared for its adoption to alter the direction of our curriculum?
- How will mobile learning impact our infrastructure? What infrastructure decisions, current and future, need to be reexamined in light of mobile learning's needs and requirements?
- How can we address the resistance to adoption that mobile learning is likely to foster?
- At what speed, and with what degree of commitment, are we prepared to launch a mobile learning initiative?
- Will a top-down approach work for adoption and management of mobile learning? Would a bottom-up approach be more organic or just unwieldy?
- What kind of financial impact will adoption have on our institution? Are we prepared to make the necessary financial commitment?
- How can we tailor mobile learning solutions to reflect the unique tenor of our institution while allowing mobile learning to change that tenor in positive, manageable ways?

Where to Learn More

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- Mobile Ed, founded by Richard Scullin, is a national resource for teachers and students integrating mobile learning with curriculum: <http://www.mobileed.org/>.

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Notes

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