

## Truly Anytime, Anyplace Learning – Mobile Computing

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**Abstract:** Since its inception online education has been billed as the opportunity to learn anytime and anyplace. Until recently, however, those times and places have been limited to times and places that a student can access a desktop or laptop computer with a network connection. With the advent of mobile technology and associated instructional media formats this is changing; students can experience truly anytime, anyplace learning via mobile hardware and mobile networking.

Online education gives participants the opportunity to engage in learning activities from a wide variety of locations, and in the case of asynchronous courses at virtually any time. The limitations to these opportunities have always been the question of where and when the students can access a computer and where and when that computer will have access to an Internet connection. In the case of desktop computers these times and places are extremely limited, and even with laptop computers there are limitations as to where and when it is convenient, or even possible, to boot up the machine and do productive work. The obvious solution to these limitations is to have a device that runs on battery power and is easy to carry around and use and also has access to the Internet via some type of wireless connectivity.

This connectivity is what mobile technology and mobile learning (mLearning) offer to the student. There are two primary categories of mobile innovation, one being hardware and the other being networking. Mobile hardware provides students with the displays and processing power to do work while the mobile networking gives them the opportunity to access information and collaborate with others. To properly utilize these resources, mLearning pedagogy must be applied that properly matches learning media with mobile technology and learning goals.

Before entering into a discussion of mobile technology it is first necessary to define exactly what mLearning is. In many ways, mLearning is simply an extension, the next step, of electronic learning (eLearning) (Georgiev, et al., 2006). ELearning utilizes electronic devices and media to facilitate the learning process, including such tasks as information storage, sharing, and collaboration. These same functions are present in mLearning; the only real difference is that mLearning accomplishes these tasks through

mobile platforms. Basically, mLearning is any eLearning application delivered via mobile technology (Caudill, 2007).

With mLearning defined, what kinds of hardware devices are parts of it? Currently there are three primary devices being used in mLearning deployment, the personal digital assistant (PDA), the MP3 player, and the mobile phone (Mellow, 2005, Andronico et al., 2003). Each of these devices offers unique mLearning tools to the practitioner that will be examined individually, but increasingly there are also combination devices that include the functionality of two, or all, of these devices. While not really a separate category, these devices do offer more flexibility in allowing a student, for example, to access media designed for both MP3 players and mobile phones if their phone has MP3 functionality.

As a dedicated device the mobile phone is perhaps the simplest piece of mLearning hardware, but it has unique advantages that are not found in other devices. The primary mLearning media delivered via mobile phone is text messaging using the Short Message Service (SMS) technology found on most modern phones. While these messages are limited to a range around 160 characters, depending on service provider, they have the advantage of being immediately received on a user's handset wherever they have service coverage. This means that messages are more easily received and in a more timely manner than e-mail, where a user generally has to deliberately access a device and check for new messages. Educational applications for this technology include sending important class updates, communication with students during field experiences, or collaboration between students who are in different locations.

Following SMS in levels of complexity is the MP3 player. Podcasting has seen rapid growth in educational applications since its inception and is continuing to find new users in the higher education community. Contrary to the name, podcasts do not have to be played on Apple Computer's popular iPod device; any device capable of playing an MP3 file can play a podcast. This range of devices includes many dedicated MP3 players from a wide variety of manufacturers as well as many new PDAs, mobile phones, and other portable devices that have built-in MP3 playing capabilities.

The most complex piece of mobile hardware that will be reviewed here is the PDA. PDAs in many ways function as palmtop computers, running an operating system, working with documents, and in the case of the more advanced units offering network connectivity. While screen size and processing power are limited compared to laptop and desktop computers it is important to keep processing power in perspective. As an example, the author completed the first year of Business school in the year 2000 with a laptop that had a 166Mhz processor. The author's current PDA has a processor speed of 306Mhz, which is more than sufficient for many routine computing tasks such as checking and sending e-mail and working with text documents or presentation slides. In addition to this, most new PDAs will also play MP3 files, which gives them the ability to be used with podcasts.

While these devices are all useful in their own way they are far more useful when they are connected to the Internet with some type of wireless networking technology. The type of wireless network varies by device and by purpose, but there are three major divisions: IEEE 802.11, known as Wi-Fi, IEEE 802.15.1, known as Bluetooth, and W3 mobile data networks.

Wi-Fi is probably the best-known wireless networking technology being used today. Most home and business wireless networks, as well as the free public wireless connections referred to as hotspots, are Wi-Fi networks. Increasingly, the 802.11g network, operating at a speed of 54 megabits per second (Mbit/s) is the most common, although 802.11b networks at 11Mbit/s are still found. Fortunately for users, devices that have either b or g network cards can work on either b or g networks. Recently several new, faster Wi-Fi standards have come to the market but for the moment these are mostly used by specific manufacturers and are not standardized across different brands of hardware.

In the realm of mLearning, Wi-Fi networking provides mobile device users with the ability to access Internet resources from a much broader range of locations than is possible with a device using a wired connection. Using this connectivity, mobile learners can access course resources, download educational media, and actively collaborate with other learners wherever they can find access for their mobile device. This means that students have the opportunity to catch up on classes or get important messages while standing in line for lunch, having their morning coffee, or even walking across campus between on-ground classes. What this delivers to the student is true anytime, anyplace engagement with the virtual learning community, an opportunity to participate in the learning experience whenever they choose (Kambourakis, et. al, 2004, Ramshirish & Singh, 2006).

A more recent, but highly popular, wireless networking technology is Bluetooth. Bluetooth networks are generally used as a method for connecting multiple devices to each other for data sharing purposes. While it is possible to share an Internet connection

over a Bluetooth network, the way that Wi-Fi is most often used, this application is not how the network is normally used. Using a Bluetooth connection it is quick and easy for a student to share data between multiple electronic devices; PDA to mobile phone, mobile phone to PDA, laptop to PDA for wireless hot sync operations, whatever exchange of data is necessary. This functionality makes the use of multiple devices easier and also facilitates the use of multiple devices for mLearning applications.

The last mobile networking technology to be examined here, and the most recent, is 3G technology. 3G is a mobile phone networking standard that provides not only voice service, but also data transfer at speeds of 384 kilobits per second (kbps). This service provides basic e-mail and Internet functionality to mobile phone handsets and for integrated devices, phones with PDA functions included, it gives students the opportunity to exchange media files, documents, and other more complex items via the network.

Having seen what the hardware and networking options are for mLearning the other side of the technology is how these systems can be utilized in a learning environment. The first, and most critical, step in incorporating mLearning into an educational environment is to ensure that the technology is available to the learners. To be effective, mLearning technology must reach a saturation point within the target population (Viteli, 2000).

If the environment has sufficient hardware and networking resources to support a mLearning initiative the next task is to decide what kind of mLearning technology will be used. The design phase will involve decisions about the content and format of information being delivered to the student, the locations that users will be working in, and the types of devices that the users will have access to (Lonsdale, et al., 2003). Depending

on the instructional environment and the intended purpose of the technology there are several questions that will help to define what type of technology will be appropriate. Does communication need to be synchronous or asynchronous? Can information be conveyed with only text, or does it require text plus images, or is video required? Can information be sent out at certain times by the instructor or do students need to have all the time access to the information at a central location?

All of these questions are directly related to the selection of appropriate mLearning technologies. If a synchronous communication environment is required then the choices of technology are limited to devices that support live text, voice, or video chat options. This generally means only PDAs, although some mobile phone technologies might provide a limited functionality for this type of application. For asynchronous applications there are a wide variety of devices that could be used, including SMS messaging via mobile phone, any type of online media supported by PDAs, and podcasts that can be recorded and shared via a download site for MP3 players.

Some text only communication, if it is short segments of information, could be sent via SMS. Longer text communication would require an interface like a PDA to access, or it could be distributed as image files to view on a video-equipped MP3 player. Text plus images would also work on PDAs or MP3 players, although the PDA format might be preferable so that the documents could be distributed as standard files such as a .doc or .pdf which are readable by pocket applications. If video media is required then the only viable options are video MP3 players and properly equipped PDAs. In this case the PDA is probably the more mobile device because it can download files through a mobile network whereas most MP3 players can not, but either device would work.

The final question is times of access to information. Some information is best when distributed on an as-needed basis. These messages can be sent with SMS directly to students' mobile phones or sent out by e-mail to whatever mobile device students are using for mobile e-mail access, although the always-on alert of SMS makes it the best way to instantly contact students. Other information works better by being posted and left for students to access as they need it or left up so that it can be retrieved at a later time. If that is the case then a course management system or download site of some kind is the best option, either of which will most often be accessed by PDA.

Mobile technology is still in the process of establishing itself in the realm of learning technologies. With an understanding of the hardware and networking technologies involved, and what these different technologies offer, the practitioner is in a position to explore the inclusion of mLearning technology in their own organizations.

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