Mobile Learning:  This Changes Everything

Edward Roach

University of North Texas

CECS 5030 AOP Spring 2014 Session B

## Abstract

Mobile Learning can be a difficult term to define, a complicated topic to discuss, and it is also a rapidly evolving concept driven by the frenetic pace of change in technology.  These challenges, however, do not obscure the truth that the effect of mobile technology on the field of learning is seismic.  In this paper, an effort is made to provide sufficient clarity of definition and historical context to make the case that there is nothing short of a mobile revolution underway and there is no opting out (Terras & Ramsay 2012).  The fundamental model for knowledge transfer has been permanently changed by mobile learning (Little 2012).  The impacts can be seen in how, when, where, and what people learn.  Mobile technology is affecting the roles of teacher and student and fueling a drive toward self-directed learning, collaboration, and learner-generated content.

## Defining Mobile Learning

In seeking to establish a common definition of what is meant by mobile learning, one can begin by realizing that the term is widely used to describe a very broad range of technology-enabled educational pursuits (Elmorshidy 2012).  Against the backdrop of this rich assortment of different examples of what the term means, an effort is made here to focus the definition by establishing certain essential characteristics and acknowledging several global differences.  When taken together, these parameters crop the definition of mobile learning into a workable and useful framed subset which can then be discussed and explored.

First, let us consider the essential technical characteristics that must be present for the term mobile learning to properly apply to an activity.  To earn the moniker "mobile" there clearly must be a battery-powered portable device involved that is small enough to be conveniently carried by a person engaged in various activities.  This effectively eliminates the notebook computer from the discussion.  The portable device must also support at least a minimum degree of multimedia

capability.  These essential technical characteristics enable a learner to undertake an educational

pursuit without the need to be tethered to a fixed location during the experience (Chan 2006).

The second essential element of mobile learning is that an actual learning experience must

take place, or at least be attempted through the use of mobile technology (El Fatouh and El-Bakry

2013).  It is acceptable, indeed helpful, to require only the most rudimentary minimum threshold of

complexity when making the determination as to whether a learning experience is taking place.

There can, of course, be complex interactive educational events and experiences supported by

mobile technology.  But, to meet the minimum and essential criteria, all that needs to be taking place

is the transfer of information that triggers enhanced understanding or new knowledge being

acquired (Motiwalla 2007).  An example of the minimally acceptable experience that could properly

be labeled mobile learning could be watching a YouTube video for do-it-yourself help in repairing or

installing a piece of equipment or to get assistance with performing a task.

Therefore *both* of these two essential characteristics must be present for the term mobile

learning, as defined here, to apply.  First, there must be portable technology in place that enables

mobility of the learner.  Second, there must also be an experience occurring that meets the minimum

definition of at least a primitive learning event.  If these two characteristics are present we have

established, for the purposes of this paper, that the term mobile learning properly applies.

Equipped with a common understanding of these two essential core characteristics, it is

helpful now to acknowledge that there is a significant degree of difference in the mobile experience

from place to place driven by underlying differences in mobile device technology across regions of

the globe (Lambeek 2009).  What is commonplace in a major US city is not likely to be

commonplace in a rural section of a country in the developing world.  Furthermore, the historical

differences in the development of technical and social infrastructure can create tangible differences

in the mobile experience when comparing the Asia-Pacific, European, and North American regions of the world (Tuunainen 2007).

For example, the presence of a 4G network has significant impact on available bandwidth to download or stream content. Older network technology often fails to support typical learning activities and also places greater demands on the power-hungry radio transceivers in the mobile devices themselves which drastically reduces effective battery life. Either one of these technical limitations, bandwidth or battery life, can serve to sharply curtail the practicality of using mobile device technology for many types of learning experiences (Veeramallu, Raghuveer, & Sairam 2013). Consider for a moment the example given above in which a learner watched a YouTube video to assist with a task. Without sufficient bandwidth the video playback may be so slow or choppy that it effectively prevents the transfer of information and knowledge. If this were to occur it would eliminate one of the two essential characteristics previously established as minimally necessary to properly apply the term mobile learning.

## History of Mobile Learning

Now that we have established a common working definition of what is meant by the term mobile learning, it is important to understand the history of mobile learning to appreciate its present state and predict potential future developments. Rapidly changing technologies can be easily misunderstood if a narrow view of the current state is the only perspective; historical context can be essential to properly interpreting current events. This type of understanding begins with the realization that mobile devices did not really begin with the mobile phone (Satyanarayanan 2011).

Little (2012) describes the early history and precursor devices of today's smartphones and tablets. He makes the claim that mobile learning really began as long ago as 1968 with the appearance of Alan Kay's Dynabook. The world's first mobile phone call was made on April 3,

1973, when Martin Cooper, a senior engineer at Motorola, called a rival telecommunications

company and informed them he was speaking via a mobile phone.  The Apricot portable (1984)

supported simple learning experiences by having a microphone for voice input as well as optical

connectors between the keyboard and screen to allow it to be disassembled and carried around. It

became common in the 1990's to see mobile phones installed in cars but the capabilities of nearly all

models were still limited to voice calls.  Personal digital assistants, or PDA's, were widely regarded as

a breakthrough technology in 2002.  They brought with them compact, full-color screens and

represented a new generation of devices equipped with faster processors that delivered a greatly

enhanced user experience (Little 2012).

As late as 2004, mobile devices weren't wireless enabled and had very limited battery life.

Mobile phones of that time had small screens and keypads.  Relatively few people had PDAs and

different models used different operating systems. About this time, Smartphones emerged – which

linked mobile phones with PDAs, so you only needed to carry one, pocket-sized device (Alexander

2004).

From those initial experiences until today, there has been a series of innovations and

advancements in the technology.  The mobile device went from being an expensive and unreliable

single-purpose gadget for the wealthy to the nearly ubiquitous and powerful multi-purpose device

that sits at the core of many life experiences for nearly a billion people today (Kim 2013).  Along the

way, several technical characteristics of the devices evolved in specific ways that now combine to

support mobile learning.

The first of these changes is the transition from a device used strictly as an analog telephone

for voice communication to a portable digital multimedia device that performs multiple functions.

This can be described as an evolution of functionality over the intervening years where people

gained the capability to *do new things* that had previously not been possible or practical with mobile

devices.  Examples of new functionality include text messaging, camera capabilities, browsing the

internet, making purchases, watching movies, and reading books.  Each of these is an example of the

evolution of functionality in mobile devices

Another transition that has occurred is the evolution of device displays.  Originally limited to

a single row of dim alphanumeric characters on an LCD screen, mobile devices gradually gained new

and enhanced visual display technology.  Screen sizes increased, color screens appeared and overall

screen resolution improved dramatically.  A smartphone today may have a display that is brighter

and sharper than that found on a desktop monitor in 1999 even though that monitor likely cost

more than $2,500 at the time.  Improved display quality is certainly part of the reason why mobile

learning is possible today (Moustafa 2013).

Another technical characteristic important to mobile learning that evolved over the years is

battery life.  This technology improved in a steady parade of elemental simplicity moving from

Nickel-Cadmium (NiCad) to Nickel-Metal-Hydride (NimH) to the Lithium Ion (Li-ion) batteries

commonly found in today's devices.  While battery chemistry was improving, each new generation

of processors and screens were also refined to require less and less power.  The combination of

better batteries and less thirsty devices is what enables us to carry smartphones with us everywhere

and use them all day between recharges (Moustafa 2013).

Finally, there is the trend toward greater memory and storage capacity for mobile devices.

When originally introduced, mobile phones had only a very small amount of internal capacity which

would not have been sufficient for any of today's rich multimedia files which can involve very large

files.  Many of today's devices have impressive RAM specifications and some come with removable

storage cards which can be upgraded to a larger size.  Even those devices with a fixed amount of

storage frequently come with 32 gigabyte or 64 gigabyte capacity which easily accommodates multimedia files to support mobile learning.

It is the combined effect of all of these evolutionary changes in device technology that creates the environment to support mobile learning.  The devices have come far indeed, but in addition to the devices themselves, the networks that support them have also evolved significantly.  Several aspects of network technology are now positioned to support mobile learning.  The first such network characteristic is the fundamental concept of coverage.  This refers to the ability of a mobile deice to connect to a network at a particular place and time.  In developed countries across the globe, the various wireless service providers have rapidly expanded their networks to cover more square miles with fewer "dead spots".  If individuals can count on getting a signal most everywhere they travel, they are more likely to engage in mobile learning when needed.

The other network characteristic important to mobile learning is bandwidth.  While not absolutely necessary to support all types of mobile learning experiences, having a high speed connection to the internet certainly enables a rich variety of mobile learning experiences.  Also, having high speed connectivity available contributes to "on-demand" or "pull" learning initiatives which occur when a learning need arises and motivates the would-be learner to seek out information in the pursuit of new knowledge (Sha 2012).

The history of mobile technology includes more than just evolutions in technology.  The acceptable use of mobile technology has also evolved as social norms and typical behaviors involving the use of mobile devices have changed over time (Pew 2012).  How, when, and where mobile technology is unabashedly present in our daily lives has evolved to the point where mobile devices are an accepted, perhaps even expected, part of an individual's persona and social avatar.  This acceptance of the use of mobile devices at more times and in more places and in more ways

builds on today's impressive functional and technological capabilities to set the stage for mobile

learning (Terras & Ramsay 2012).

## Mobile Learning Today

Even in light of all the tremendous capabilities of mobile technology it is still possible to take

a narrow view of mobile learning.  This perspective is summed up in the expression "mLearning".

When referred to in this manner, the image served up in the mind conveys a relatively subtle change

from eLearning to mLearning.  In this limited line of sight, the only thing that has changed is that

the computer in the eLearning world has become the smartphone or tablet in the mobile world so

the experience is now called mLearning (Little 2013).

This narrow view is reinforced when mobile technology is implemented and managed as a

controlled environment with defined purposes in a specific timeframe.  This can be understood if

you consider the example of a company-issued cell phone where the employee had little choice in

selecting the device so it is inherently less personal.  Furthermore, a device of this type is often

restricted or "locked-down" by a corporate group security policy that precludes or savagely restricts

functionality.  This loss of potential is exacerbated when the employee, or student, seeing limited

value from the restricted and impersonal device, chooses to turn it off or not carry it for a significant

amount of time each day.

On the other hand, and diametrically opposed to the term mLearning, is the point of view

that considers the holistic mobile *experience* and its unbridled potential.  In this model, the learner is

an unfettered and empowered user of mobile technology free to explore this powerful capability

when the need arises.  This open and broad view enables spontaneous new opportunities for

learning related to more topics and occurring at more times in more places (Little 2012).  The

freedom that derives from this scenario can manifest itself in the frequent use of mobile technology

to "pull" information as opposed to an mLearning device to which content is simply "pushed." The true mobile learning experience takes full advantage of the freedom to choose topics of interest and start and stop learning experiences at will (Sha 2012).

Learner-generated content and collaboration are also hallmarks of this broader view of the mobile experience. With increasing frequency, the Bring Your Own Device (BYOD) scenario is found where it is the individual bringing his or her own mobile technology to work or school. This growing habit fuels demands for institutions to provide something close in capability to what individuals can get nearly for free (or actually for free) on their own devices and networks. Students and business managers alike are typically pressingfor service delivery on next-generation mobile devices like the iPad along with easier to use IT solutions and access to better, more collaborative and useful intranet capabilities (Hinchcliffe 2011). This freedom and sense of ownership encourages the formation of fluid and dynamic learning goals that reflect the priorities and preferences of the learner.

## Revolutionary Impacts of Mobile Learning

Armed with a common definition, equipped with a sense of history, and embracing this broader view of mobile learning, it is now possible to consider the impacts of mobile learning. The first impact of mobile learning is an eponymous one in that learning is no longer restricted to a particular fixed location, it can start anywhere and continue while the learner is mobile. The requirement to be in a particular physical location is decoupled from the ability to participate in a learning experience (Elmorshidy 2012).

Related to the idea of mobility is concurrency, the new ability to engage in learning while simultaneously committed to another task. This is not the same as multi-tasking, but rather the ability to learn during windows of availability during other activities. An example of this would be a

commuter who completes an online learning module on the train or someone who joins an online

webinar or virtual session during her lunch break from work. Without mobile learning those

activities would not be possible at all in the case of the lunchtime webinar or limited at best in the

case of the commuter (Jones, Issroff, Scanlon, Clough, & McAndrew 2006).

Another impact of mobile learning is the ability to shift the time of learning to a convenient

one for the learner. Consider again the example given above of the commuting learner. Not only is

the location of learning shifted to the train, learning can be at the time of day chosen by the learner.

Whether there is a concurrent task or not, the shifting of time is a very significant concept that

opens up learning opportunities to a vast number of individuals who would otherwise be unavailable

at traditional class times (Chen 2013).

Yet another dimension to this time shifting is that learning can now take place closer to the

*time of need* for the new knowledge. Furthermore, if learning can take place closer in time to the

need, it is also now possible that learning can take place closer to the *location of the need.* This

improved proximity has the potential to substantially improve motivation and focus for the learner

since the need is clear and the "payoff" is immediate (Jones, et al 2006). Choosing to learn wherever

you are and when the need for knowledge is clear and present is hallmark of mobile on-demand

learning.

The final temporal impact of mobile learning is the very real possibility of lifelong learning.

As a result of the flexibility in time and place described above, mobile technology now makes it

possible to engage in learning throughout one's lifetime. It is no longer necessary to have the free

time and sufficient means to travel to a university or learning center. This new freedom impacts

career development for professionals as well as vitality of mind for individuals older than traditional

students who now have the opportunity to learn by leveraging mobile technology. There is a natural

association between lifelong learning and mobile learning since many people are on the move –

therefore mobile -- throughout their lives (Sha 2012).

Beyond all of these impacts of time and location, mobile technology enables greater

personalization of the learning experience (Little 2013).  Mobile devices are by their nature personal

devices that reflect individual preferences and personal characteristics.  A touch-screen interface is

personal and a mobile device is also viewed at close range which is personal.  The selection of a

particular mobile device itself is usually the result of a personal choice, and these devices frequently

contain a significant amount of personal data such as photos, contacts, messages, and "live"

connections to multiple social media environments (Alexander 2004).  One needs only to consider

the deep sense of loss associated with a stolen or damaged smartphone to appreciate the strong

personal connection between people and their mobile devices.  According to the 2012 Pew Report

on Cell Phone Attachment and Etiquette, 36% of smartphone users "couldn't imagine living without

their cell phones."

This personalization manifests in how mobile learning takes shape.  The characteristics of

mobile learning described above can result in small, frequent learning experiences focused on

granular and specific topics that have personal relevance and immediate value to the learner.  Mobile

learning permits individuals to choose the content they consume and the manner of delivery they

prefer.  The result can be viewed as a just enough, just-in-time, just-for-me personalized, tailored

learning journey (Kearney 2012).

Another illustration of this personal freedom to choose can be found in the wide variety of

smartphones available today with significant differences in screen size, battery life and operating

systems.  There is far more variation in mobile devices than there is in personal computers.

Personalization is also expressed when an individual elects to use a smartphone or a tablet (Hinchcliffe 2011).

The revolutionary impact of mobile learning is also apparent in the redefining of traditional roles of teacher and student. Peer-to-peer learning is facilitated by mobile technology due, in part, to the fact that individuals already use mobile technology to communicate with others and this naturally finds its way into learning experiences as well (Jones, et al 2006). Learner-generated content is another concept facilitated by mobile technology since it gives each learner a megaphone to share what they know in ways fundamentally different than a classroom model. In the virtual world of mobile learning there is no fixed limit to the number of individuals who will see or hear your learning suggestions and comments. You don't have to raise your hand before you speak in mobile learning, and thousands can end up hearing what you have to contribute.

Several of the impacts already listed have the potential to combine in a synergistic fashion in the form of online communities and collaboration. In addition to sharing information and learning *from* each other, mobile technology enables the ability to learn *with* each other (Lai 2009). This is one very clear-cut example of how mobile learning today differs from eLearning or computer aided instruction of yesterday. Those learning experiences often occurred on computers where the learner was discouraged, or outright prohibited, from communicating with others during the learning experience.

Finally, the combined effect of these revolutionary impacts of mobile learning can be viewed as creating an ecosystem where the individual effects interact with each other. In some cases this takes the form of one effect enabling another, while it is equally consistent with the ecosystem metaphor to consider how one impact can have a limiting or regulating effect on another. The dynamic model feeds on itself and generates energy in an attempt to become self-sustaining.

According to Little, the result is that "increasingly – since about 2006 – consumers want to use mobile devices for learning and for less formal performance support" (2013).

## Conclusion

By changing how, when, what, why, and with whom we learn, mobile technology has dramatically altered how knowledge is transferred.  This affects the very core of the learning experience.  Self-directed learning through mobile technology now empowers learners to gain control and accept responsibility for their own growth and development.  Peer-to-peer learning and collaboration can trigger a network effect making possible an exponentially greater number of interactions between those with knowledge and those with a desire to learn.  Mobile learning has enabled the creation of new ecosystem for knowledge exchange with the learner at the center and fully in charge and open to collaboration.  Mobile learning changes everything because every single attribute of a learning experience is altered when viewed through the lens of mobile technology.

References

Alexander, B. (2004).  Going Nomadic: Mobile Learning in Higher Education. *Educause Review,* September/October

Chan, T-W., Roschelle, J., Hsi, S., Kinshuk, Sharples, M. et al. (2006) One-to-one Technology Enhanced Learning: An Opportunity for Global Research Collaboration. *Research and Practice in Technology Enhanced Learning,* 1(1), 3-29.

Chen, M., Ma, Y., Liu, Y., Jia, F., Ran, Y., & Wang, J. (2013). Mobile Learning System based on Cloud Computing. *Journal Of Networks, 8*(11), 2572-2577.

El Fetouh, A. El-Bakry H. Article: A Novel Adaptive Mobile E-Learning Model. *International Journal of Computer Applications* 63(14):12-25, February 2013. Published by Foundation of Computer Science, New York, USA.

Elmorshidy, A., PhD. (2012). Mobile learning - A new success model. *Journal of Global Business Management, 8*(2), 18-27.

Hinchcliffe, D. (2011). The "Big Five" IT trends of the next decade: Mobile, social, cloud, consumerization, and big data, *Enterprise Web 2.0*

Jones, A., Issroff., K, Scanlon, E, Clough, G and McAndrew, P (2006) Using mobile devices for learning in Informal Settings: Is it Motivating? IADIS International conference Mobile Learning.

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. *Research in Learning Technology, 20*(1), 1-17

Kim, B. (2013). The mobile shift. Library Technology Reports, 49(6), 5.

Lai, C. H., Yang, J. C., Chen, F. C., Ho, C. W., & Liang, J. S. (2009). Mobile technology supported experiential learning. International Journal of Instructional Media, 36(1), 41.

Lambeek, A. (2009). Mobile technology: Driving change and opportunity in developing countries. *International Trade Forum*, (3), 26.

Little, B. (2012). Effective and efficient mobile learning: Issues and tips for developers. *Industrial and Commercial Training, 44*(7), 402-407.

Little, B (2013). Issues in Mobile Learning Technology, *Human Resource Management International Digest* 21(3), 26-29.

Motiwalla, L. (2007). Mobile learning: A framework and evaluation. *Computers and Education, 49: 581-596*

Moustafa, H., Maréchal, N., & Zeadally, S. (2012). Mobile multimedia applications: Delivery technologies. IT Professional, 14(5), 12-21.

Pew Research Center. (2012). The Best (and Worst) of Mobile Connectivity. http://pewinternet.org/Reports/2012/Best-Worst-Mobile.aspx

Satyanarayanan, M. (2011). Mobile computing: The next decade. ACM SIGMOBILE Mobile Computing and Communications Review, 15(2), 2-10.

Sha, L., Looi, C.-K., Chen, W. and Zhang, B.H. (2012), Understanding mobile learning from the perspective of self-regulated learning. *Journal of Computer Assisted Learning*, 28: 366–378.

Terras, M. M. and Ramsay, J. (2012), The five central psychological challenges facing effective mobile learning. *British Journal of Educational Technology*, 43: 820–832.

Tuunainen, V. K., & Rossi, M. (2007). Mobile technology in field customer service: Big improvements with small changes. Business Process Management Journal, 13(6), 853-865.

Veeramallu, B. and Raghuveer, A. & Sairam, U. (2013). Analyzing the generations of mobile technology. International Journal of Soft Computing & Engineering, 2(6), 467-470.

Walker, K. (2006). Introduction: Mapping the Landscape of Mobile Learning: Big Issues in Mobile Learning, *Report of a Workshop at University of Nottingham by the Kaleidoscope Network of Excellence.*