

# Mobile Learning: A Review of Implementations

Angela van Barneveld  
Concordia University  
Canada

[evang\\_va@education.concordia.ca](mailto:evang_va@education.concordia.ca)

Steven Shaw  
Concordia University  
Canada

[shaw@education.concordia.ca](mailto:shaw@education.concordia.ca)

**Abstract:** Mobile learning is 'au courant', a term applied to almost anything that has no wire and fits in to a pocket. It is a term applied to devices designed for communication, rather than pure learning, yet the claim is learning. Studies that attempt to measure impact on learning have returned mixed results. Ultimately, the current research reflects that mobile learning remains a vision moreso than a reality at this point in time.

## Introduction

The ubiquity of mobile devices is undeniable and evident everywhere one turns – cell phones, PDAs, Blackberries, Redberries, Tablet PCs, Pocket PCs, iPods. These are information and communication devices, designed for that purpose – always wireless, sometimes connected. The plethora of devices cannot help but entice any tuned-in learning professional to jump into the fray to explore and investigate possible applications to learning. We develop a ream of catchy acronyms to establish presence – JILL (just-in-location-learning), LBL (location-based-learning), LOD (learning-on-demand), JIT (just-in-time), and a personal favorite, WINWINI (what-I-want-when-I-want-it). Learning is anytime, anywhere. There appears to be a lot of learning going on; specifically, mobile learning.

The purpose of this paper is to present a review of case study research that focuses on the implementation of mobile technologies for the purposes of learning. Specifically, this review sought out case studies that measured, or attempted to measure, learning impacts and outcomes. Several studies were found to focus on perception of usefulness, and/or perception of impact on learning, without attempting any actual measurements of learning.

This paper starts with a review of the definitions of mobile learning, merely to set a baseline general frame of reference for the term, mobile learning. Implementations of mobile learning in different areas are presented and include language learning, industry, medical/clinical practice, and education. The summary addresses the current state of mobile learning, as discussed in the various areas, and provides final thoughts on perspectives and direction.

## Definitions of mobile learning (mLearning)

The ubiquity of mobile technologies has challenged researchers to investigate the uses of these devices for learning, and finding a single consensual definition of mobile learning remains one of those challenges. Some definitions focus on the technology, while others focus on the mobility, and yet others focus on learning and performance.

Milrad (in Attewell & Savill-Smith 2004) defines mobile learning as eLearning using mobile devices and wireless transmission, where eLearning is defined as learning supported by digital electronic tools and media.

Desmond Keegan (2002), who indicates that the focus should be on mobility, defines mobile learning as “the provision of education and training on PDAs/palmtops/handhelds, smart phones and mobile phones.”

O'Malley et al. (2003) define mobile learning as “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.”

Metcalf (2006) indicated that the goal of mLearning is to “develop learning content that integrates with mobile applications and provides learning and performance in a just-in-time, just-in-place dynamic.” S.J. Geddes (2004) states, “mLearning is the acquisition of any knowledge and skill through using mobile technology, anywhere, anytime, that results in an alteration in behaviour.”

The definitions are varied and overlapping. A much more in-depth review of the various definitions of mLearning can be found in Laouris and Eteokleos (2005), whose premise is that an educational definition of mobile learning is still required.

## **Language learning**

The environmental context cannot be overlooked when reviewing studies that discuss mobile technology implementation, particularly formal versus informal learning settings.

Levy and Kennedy (in Kukulska-Hulme & Traxler, 2005) and Thornton & Houser (2004) studied language learning in formal learning settings, universities. Both studies used the approach of sending vocabulary-related messages through SMS on cell phones using a push methodology. Results revealed student preferences for timing, number of messages, repeated messages, and prompts for recall. Students liked the approach and thought the SMS technology was appropriate for language learning, but there was no reported evidence of learning in the Levy and Kennedy study. Thornton and Houser measured vocabulary learning with pre- and post-tests. Results indicated that learners using a mobile push technology learned significantly more words in two weeks than a mobile web pull technology.

In these cases, the affordances of the mobile devices, namely portability and immediate access, were uniquely positioned to meet the user needs within the given environment. In the formal setting (university course), the mobile device served as a component of a blended learning approach that offered reinforcement of language learning. For Pincas' proposal, she indicated that her cell-phone-based SMS proposal was a replacement for a book, and that the portability of the cell phone, along with the customizable access to specific content is where the advantage existed over a book. Pincas speculated that the low uptake of her proposal was that survey respondents may not have fully understood the implementation plan.

## **Industry / Business**

In industry, the focus of mobile learning is more on the enhancement and support of performance, rather than on pure learning. Movement from formal to informal, instructor-centered to learner-centered and increased worker mobility all lay the groundwork for implementations of mobile technologies to provide immediate access to information, whether push or pull, for faster and better decision-making (Edwards, 2005; Wagner, 2005). Predominant features used with the mobile devices continue to be communication and information-based, with email, schedules, and contact information being the most frequently reported.

Prekop (2003) conducted a study of 10 senior staff and managers to determine what PDA applications were used, how, and where (PDA did not have wireless connectivity). The usage curve revealed high usage in the first 7 to 10 weeks, with a steady decline in usage over the remainder of the study period. The researchers indicated that configuration and customization of the device was the reason for the initial high usage. Because training was not provided on how to use the device, the initial learning curve of participants may have also been a contributing factor to initial usage rates. The most frequently used applications were the Calendar and the Contact Information; the latter considered very useful by participants, as the information would have otherwise been difficult to mobilize without the PDA. Use of the PDA was opportunistic, accessed during down-time and travel, to catch up on background reading or low-priority emails. Anything requiring more sustained attention and concentration was addressed when participants had access to a laptop or desktop computer.

Gayeski (2004) summarizes a study of the implementation of customer enabling technologies in some hotels, a marketing strategy based on convenience. Guests were provided with a Personal Digital Assistants (PDA) at check-in. Not only did the mobile device contain information about room service, local attractions, spa specials and gaming, but transactions could also be carried out on the PDA. The novelty effect seemed to support impulse buying and, consequently, resulted in higher final hotel bills.

Newcomb, Pashley, & Stasko (2003) conducted a study of mobile devices in retail – a grocery store application, to be exact. After entering their shopping list on the PDA, the wireless network within the store would

send information to the PDA based on the shopping list and the shopper's location in the store. Feedback from shoppers indicated that the PDA made the shopping experience more focused and efficient, and they speculated that it reduced impulse shopping. One can only speculate about the reaction of grocery store management to the reduction of impulse buying. One limitation reported by the shoppers was that they did not like to hold the device while shopping, preferring to have their hands free to interact with store products.

The primary issue addressed with mobile technology in the corporate arena is rapid and timely access to information, in support of decision-making and performance. Where the user has complete control over when and where they obtain information is a feature unique to mobile technology. Mobile learning is ideally positioned as part of a blended strategy that primarily supports performance and can augment learning (Gayeski 2004; Wagner 2005; Metcalf 2006; Stead et al. 2006). In his Comprehensive Learning and Performance Support Model (Figure 1), Metcalf (2006, p4) suggests that the best fit for mobile learning is within the performance support space.

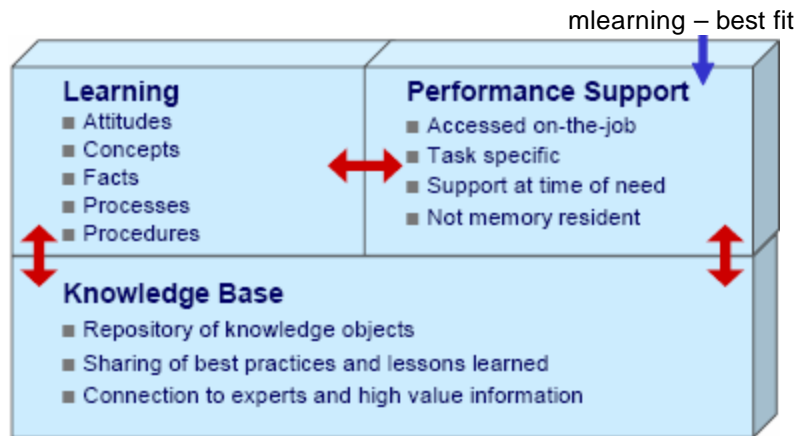


Figure 1: Comprehensive Learning and Performance Support Model (Used with permission of author, David S. Metcalf II 2006). © HRDPRESS, Inc.

## Medical / clinical practice

The two primary themes that emerged in the case studies reviewed were data collection strategies and point-of-care performance, including decision-making and evidence-based practice. In the area of clinical practice, the research focused less on measurable learning and, instead, addressed the requirements of staff with regard to support for work activities.

The PDA-based resources to support performance include patient data, clinical practice guidelines (CPG), evidence-based medicine (EBM), medical reference documents, and data access and data capture tools. On the one hand, use of these resources resulted in increased data collection and thoroughness, decreased data recording times when compared to paper methods, and direct download in to the database, which was not possible with a paper-based data capture strategy (VanDenKerkhof et al. 2003; Spain et al. 2001). On the other hand, Carroll et al. (2004) concluded that the PDA system failed to provide a clear benefit in reducing documentation discrepancies.

Johnston et al. (2004) studied 4<sup>th</sup> year medical students in Hong Kong and whether the just-in-time support offered by the use of a clinical decision support system (CDSS) on a PDA at the point-of-care would improve or enhance the learning experiences. Although there was an implication of impact on learning, there was no evidence presented to support the claim. One other note of interest in the Johnston study was that PDA/CDSS use was discouraged not only by the time required to retrieve information, but also by the learning culture, where teachers encouraged the students to approach them as experts rather than turning to the PDA.

In the medical setting, the main intent is to have mobile devices, predominantly PDAs, support clinical practice (performance and decision-making) through resource/information access and data capture. The efficiencies that PDAs offered as data capture devices were described, although not always realized (data synchronization and transfer to a main database). Without the focus on learning impacts in the clinical setting, attentions turn to impacts on performance and, clearly, the evidence that demonstrates an impact on quality of patient care with the use of mobile technologies is still to be determined.

## **Education (K-12; higher education; medical education)**

Implementations in higher education appear to be primarily exploratory, where identifying preferences and usage patterns was more of a focus than measuring any sort of learning impact. Luckin et al. (in Kukulska-Hulme & Traxler 2005 p116-124) found that students appreciated the connectivity of PDA, but device alone is far from enough for learning. Sharples et al. (in Kukulska-Hulme & Traxler 2005 p139-149) assessed students' perceptions of PDA usefulness. Students found the PDA useful, but it did not transform or enhance learning. The PDA complemented use of desktops, but no evidence that it replaced other established devices such as cell phone or MP3 player. Smordal and Gregory (in Kukulska-Hulme & Traxler 2005 p99-105) reported similar findings that the PDA did not offer sufficient support for JIT interactions and could not compete with the existing communication system of cell phones and pagers. Ramsden (in Kukulska-Hulme & Traxler 2005 p84-91) reported that 1st year student said Internet-connected Palm had little to contribute to their current learning experience.

One of the reported uses of the mobile technologies was to enhance instructor-student interaction in the classroom, particularly in large classes in excess of 250 students (Ganger et al. 2003) or where such interactions are discouraged by cultural norms (Weber et al., in Kukulska-Hulme & Traxler 2005; Johnston et al. 2004). Jackson (2005) also discussed clever uses of PDAs for testing purposes, and mentioned the need to address high-stake issues like security and cheating.

Grad et al. (2005) studied the effect of a PDA-assisted course on a written knowledge test that assessed primary care management of hypertension and diabetes, and assessment of disease probability. Results indicate that there was no significant effect of the PDA-based source on test scores. Test results improved 7.4% with the use of the PDA during the test.

An oft cited study by Chen et al. (2003) reported on a scaffolded bird-watching learning system implemented in three elementary schools in Taiwan. Students were provided with a PDA-based learning system to support learning. In post-test scores, results revealed that students using the PDA to support learning significantly outperformed students who were using only guidebooks as a source of learning support and as a discovery tool.

Kontos (2001) surveyed university faculty on their perceptions and attitudes toward laptop usage in class at a Middle Eastern university with a 13-item questionnaire. Although faculty responded positively (at least 80% agreement) to almost all questions (fun, improves technology skills, enhances student job prospects), the two questions that received less positive responses were revealing. When asked if having the laptop made them better teachers, faculty responses were about 54% yes, while 45% said no, and 5% did not respond. When asked if students learned better in a laptop university, 55% of faculty said no, 30% said yes, and 15% did not respond.

Kim et al. (2006) indicate that there is great potential for the use of m-technologies in higher education, but that current research has yet to demonstrate benefits of mobile technologies in higher education. Indeed, although there is considerable exploratory investigation in higher education, and several studies have assessed perceptions and attitudes, not much research exists that shows impact on learning, or clearly articulates the problem being solved by mobile devices.

## **Summary**

The ubiquity and popularity of today's mobile devices cannot be denied. The opportunities that these devices present with regard to just-in-time access to information and anytime communication, assuming networks are up and batteries are charged, cannot be matched by any other technology. However, the panacea of mobile devices for the purposes of learning has yet to be realized. Kukulska, Evans, & Traxler (2005) advise caution about claims that the new technologies can be used anywhere, anytime - pedagogical, technical, logistical, usability, and social constraints must not be overlooked. With regard to continuing medical education (CME), Rossett & McDonald (2006) indicate that while there are reasons to anticipate that online CME has the potential to improve clinical performance and patient outcomes, there is little data to support that positive assertion. Keough (2005) suggests that mlearning alone is a technology-driven concept. He agrees that mobile devices can be used in learning, but cautions that they are mostly designed for use as consumer products, not education mediation devices. Clark Quinn thinks mobile learning is "more potential than reality now," and Chris von Koschembahr of IBM predicts it will be 5 years before mobile learning is "widespread in any incarnation" (Kaplan-Leiserson 2005).

M-information? Yes. M-performance support? Absolutely! M-access? Sure. M-learning? Maybe not quite yet.

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