Author: Todd W. Zabel, J.D.
Date of Publication: April 15, 2010
Title: Viability, Advantages and Design Methodologies of M-Learning Delivery

Abstract

The purpose of this study was to examine the viability and principle design methodologies of Mobile Learning models in developing regions. Demographic and market studies were utilized to determine the viability of M-Learning delivery as well as best uses for such technologies and methods given socioeconomic and political conditions within the target regions. Amongst markets and population segments where M-Learning case studies had been conducted, analysis of learning methodologies used to support those programs is also presented here. It is concluded that while technical challenges such as hardware limitations and mobile network infrastructure development present obstacles to the expansion of M-Learning in developing regions, the proliferation of mobile device ownership, rapidly improving mobile technology and consumer cost considerations make M-Learning delivery an increasingly viable and effective choice for new learners in regions where such opportunities were scarcely available previously.

Introduction

Increasing costs of maintaining physical learning facilities, proliferation of mobile device ownership, improvement of mobile network infrastructure, and growing demand for sophisticated learner-centered technologies are creating excellent conditions for the emergence of Mobile Learning or 'm-Learning' as a standard in education. Analysis of the suitability and advantages of m-Learning as well as techniques for implementing high-quality mobile-oriented training will be presented and discussed. This data will provide an overview of

the viability of this delivery method as a replacement for, or supplement to, current physical classroom educational models as well as standard computer-based distance learning.

Additionally, m-Learning is an area of professional opportunity for me as a small business owner and online training provider. In my home business, I offer free online education. I am the sole proprietor and perform all functions for the business, including web design, web programming, database design, marketing, monetization, search optimization, business development and customer service. Over the past four years, I have noticed a surprising number of enrollments from students in developing regions. Students from Nigeria and other countries in West Africa have enrolled in my courses in relatively high numbers and I receive excellent feedback from these students who appreciate the opportunity to study online for free. However, I have realized that if I were able to repurpose the course framework and content for mobile delivery, I would likely enjoy increased enrollments in the developing world because of the high rate of mobile device ownership and mobile network access in those regions.

What is m-Learning?

m-Learning (mobile learning) could simply be described as learning facilitated by mobile devices (Valk, 2010). However, the definition quickly becomes more complex as the variety of mobile platforms and delivery models are considered. To that end, describing mobile learning as wearable technology which facilitates learning at anytime and anyplace may be more appropriate (Shih, 2005). As a subset of e-Learning, m-Learning represents an extension of distance education technology which enables new learning among groups which previously had limited access.

Yiannis Laouris (2005) described this shifting educational paradigm:

> The dominant terms in the e-learning era were: multimedia, interactive, hyperlinked, media-rich environment, etc. In the m-learning era terms like spontaneous, intimate, situated, connected, informal, lightweight, private, personal etc. are used to characterize the context. (p. 11)

This changing terminology is informative as to the evolving expectations of the learner who has greater control over their educational experience.

While distance education continues to progress, the educational landscape and expectations regarding continuing education have also evolved. Life-long learning is expected to occur for all professionals and, thanks to distance education, including m-Learning, there is no shortage of relevant training opportunities offered in flexible, asynchronous formats (Geddes, 2004). In terms of expectations, learners and educators are using the expanded capabilities of mobile technology to meet the increasingly demanding learner-centered requirements of higher education and continuing education. Constructivist learning models are in fact enabled by m-Learning due to social software applications allowing new channels of collaboration and community within today's multi-functional mobile devices. Dr. Tom Brown (2003) observed that communities of practice are beginning to play a significant role in teaching and learning environments (p. 2). The learning community itself can be the 'instructor' within m-Learning programs. Social software applications which enable collaboration and crowd-sourced knowledge acquisition are well positioned to meet the evolving needs of growing m-Learning program popularity (p. 3).

The changing needs of the student are not the only driving force behind the growth of m-Learning. Incredible advances in mobile technology, including the relatively low price of hardware are causing consumers to rethink how they access the internet and communicate with their peers. In fact, many consumers are beginning to see mobile devices as an alternative to or replacement for the desktop computer, or PC (Attewell, 2005). These market conditions paired with rapid mobile device innovations are clear indicators of the growth potential of m-Learning on a worldwide scale.

Access, Availability and Shifting Attitudes

There are many advantages of m-Learning, not the least of which is the fact that the learner can engage in the learning community from anywhere at any time. The device's mobility creates value for the learner because it permits greater control over the educational experience (Traxler, 2005). Beyond ownership, the learner also has greater responsibility for the learning experience as they are able to plan their schedule and consume educational content as their professional and/or family obligations dictate, taking advantage of intervals of downtime. (Valk, 2010). Indeed, the flexibility of m-Learning delivery has growing appeal and is a major selling point for this new model. Professor Yushun Shih (2005) stated that "in mobile learning enabled environments, students are able to utilize their leisure time for online classroom participation, such as waiting for bus or in traffic, etc" (p. 90). It is noteworthy that at least one pilot study of an SMS-based m-Learning program in Mongolia reported that most students still turned in their required exercises and assignments at the deadline and relatively few students utilized downtime during the day to engage in learning exercises (Valk, 2010).

This flexibility can also be interpreted as a lack of formality, helping to shift attitudes of some learners toward what may be perceived as a more relaxed approach to learning. Although standards of progress and achievement remain static, a reluctant learner's anxiety about engagement in traditional classroom settings may be lessened in a mobile learning program (Attewell, 2005).

Cost Advantages

While most distance programs are less expensive than classroom trainings due to reduced facilities costs, m-Learning programs are even more cost effective for the student because of the lower hardware cost (as compared with a PC) and the fact that most mobile devices are multi-functional. As an example, most smartphones are able to serve as phones, web access points, word processing applications, video players and even gaming or GPS devices, among other functions. The combined functions of the device make it an excellent value for the consumer, and as such, m-Learning programs can leverage products already owned in large numbers by the student demographic. But not all m-Learning programs use such sophisticated software. In fact, a major strength of m-Learning is its ability to provide training to the lowest common denominator among mobile devices and network capability using SMS technology. The costs of this simple delivery method can be scaled to meet the needs of the learning community as SMS message plans may be purchased in bulk by educational institutions (Traxler, 2005).

Expanding infrastructure to Support Proliferating Mobile Device Ownership

In developing regions, the cost of building and maintaining a national infrastructure to support traditional telephony, and broadband technologies for classroom-based learning can be prohibitive. However, many developing nations are choosing instead to invest in the more cost-effective mobile phone network infrastructures which support the incredible proliferation of mobile device ownership in those countries (Traxler, 2005, Motlik, 2008).

Matthew Kam (2009), in his discussion of learning games in rural India stated:

> Cell phones are increasingly adopted in the developing world, and an increasing fraction of these phones feature multimedia capabilities for gaming and photos. These devices are a promising vehicle for out-of-school learning to complement formal schooling. (p. 1)

Teaching Advantages

Learners are in an historically excellent position to choose from among a plethora of learning opportunities. With so many competing instructional, pricing and delivery models, it has never been more important to appeal to the learner, both in terms of student recruitment and in terms of achieving optimal academic performance and professional placement (Geddes, 2004). Again, mobile devices are particularly well suited to this competitive marketplace because of their numerous supported channels of communication, such as email, SMS, MMS, and email which cater to a learner-centered experience (Traxler, 2005).

Among the greatest beneficiaries of m-Learning are students in the developing world. The availability of mobile network infrastructure, particularly in sub-Saharan Africa (Brown, 2003), low cost and high availability of multi-functional hardware, and the availability of low bandwidth requirements for time-shifted course interaction are all reasons for its growing success in developing regions, both urban and rural. (Valk, 2010) Consumers in developing

regions are also among the highest adopters of mobile devices, making those regions particularly accommodating to this delivery method (Brown, 2008).

A Glimpse of m-Learning Methodology and System Requirements

Given the diverse hardware, network and software variables at play in m-Learning, a consistent theme among m-Learning instructional design documentation involves cross-platform compatibility. As such, activities within the learning environment should be designed with the learner's device platform in mind or, failing uniformity among student devices and network access, activities may support the lowest common denominator so that each student can participate equally in the program without interruption (Dye, 2004).

A number of other standards have been developed to ensure the best possible student experience within the mobile environment, including zoom functionality for course content images and text, and mechanisms to provide meaningful and immediate feedback to the learner. In addition, synchronous communication tools such as chat and asynchronous tools such as email and m-LMS message boards are also desirable if not essential for the m-Learning delivery method to facilitate community-oriented learning (Dye, 2004). Finally, because of the mobility of the student between zones of network access, and due to the flexible nature of the delivery method, it is helpful for the student to be able to download content or activities so that work may be performed offline (Attewell, 2005).

Challenges

While the rapid advance of mobile technology and network infrastructure is impressive, inherent limitations of this delivery platform should not be overlooked or dismissed. Principal limitations of mobile device use in learning include variant display size and color specifications,

and small sizes of the device buttons (Rekkedal, 2007). Display zoom features on many handheld devices are useful, but compromise the user experience by necessitating page scrolling, some of which requires page refreshes and network availability on certain models (Traxler, 2005).

A secondary limitation of mobile delivery, particularly with respect to SMS-based m-Learning programs for students who are members of nomadic groups is that the primary data point for contact is the student's mobile phone number. If the number is changed or if service is disconnected, it is often very challenging if not impossible to reestablish contact in an academically acceptable period of time (Valk, 2010).

Appropriate user interface design also lags for some emerging markets. According to Valk (2010) regarding m-Learning pilot programs in rural Bangladesh, "some participants expressed difficulty with sending SMS messages because SMS could only be sent using English characters, and they were not comfortable with the English alphabet" (p. 133). Other hardware limitations include quick battery power consumption by high-performing devices. Particularly in regions where electrical infrastructure is poor, this device requirement can be very limiting to the learner who is mobile throughout the day and is using high power consumption features such as web access or telephony functions (Traxler, 2005). In addition, due to the limited physical space in mobile devices, local data storage capacity is limited. Therefore, it is more sensible to utilize storage and services in 'the cloud', if network access is consistent and robust (Traxler, 2005).

Beyond hardware limitations, it has been found that some adult learners who are late adopters of digital technology, and specifically mobile technology, encounter many difficulties

interacting with complex computer interfaces (Traxler, 2005). Students may also feel added pressure to take on too many educational obligations because of the inherent flexibility of mobile device learning and the risk of academic failure increases (Traxler, 2005).

Finally, while mobile learning content can typically be repurposed for traditional distance learning delivery via desktop computer or laptop, those desktop-enabled learning activities and content are typically not immediately suitable for m-Learning delivery because that content must be repurposed for the smaller display, limited bandwidth and user-experience considerations which must be factored into m-Learning instructional design (Siraj, 2006).

Applications to Current and Future Professional Endeavors

After this course is complete, I will implement a plan for online training intended for delivery via mobile device for adult learners in developing regions. This training program will be an extension of my current legal mediation training program offered through the California State Bar Association. Utilizing the learnings from this project, I will develop an m-LMS with m-Learning-appropriate content and technical specifications, including an SMS-based alert and subscription system coded with the help of PHP libraries and MySQL. The parent LMS will detect mobile clients and redirect users to my mobile site where they can access and enjoy the same educational benefits as students of my traditional distance learning program.

Existing market conditions and mobile network infrastructure in developing regions, as I discovered in the course of this research, should facilitate the growth of my mobile-oriented training program. My takeaways from this project have been that this plan is feasible within my

current programming and instructional design skill set and has a good chance for success within my existing student base in West Africa.

Summary of Research

m-Learning is an emerging subset of distance education which offers tremendous opportunities to educators and learners around the world. The widespread availability and low cost of mobile devices, paired with their multi-functionality and the relatively high rate of accessibility to mobile network infrastructure create excellent conditions for achieving successful adoption of m-Learning programs, particularly in developing regions. In addition to hardware and software advantages, the mobile delivery method provides a more flexible format for educational content consumption by adult learners, and learners in remote and developing regions. Notwithstanding the challenges of increasingly sophisticated hardware and network capabilities, m-Learning helps to attract new learners to take advantage of learner-centered training which leverages SMS, MMS, email, web access and computing advantages of mobile-enabled learning communities which facilitate a constructivist approach for maximum professional relevance like never before. The development of learner-centered m-LMS standards and instructional design methodology further strengthen this delivery model for the future and will ensure its competitiveness alongside traditional distance education programs and physical classroom training.

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