

Characteristics of Mobile Learning Environments in Developing Countries

Umera Imtinan, Curtin University, Western Australia, Australia
Vanessa Chang, Curtin University, Western Australia, Australia
Tomayess Issa, Curtin University, Western Australia, Australia

Abstract: This paper examines and reviews the current literature on mobile learning in developing countries. Mobile device is becoming a more popular interface for connecting with the world and mode of digital presence than the desktop computing devices. Mobile technologies in the developing world enable people to connect to the Internet, become more conversant with the digital world, and network globally via social networking forums. Mobile technologies in developing countries such as India, Indonesia, Pakistan, Kenya and South Africa have significantly increased and advanced. In spite of limited Information and Communications Technology (ICT) resources and an unstable infrastructure, good telecom services exist in the form of cellular networks which provide a favorable environment for mobile learning. The literature suggests that there is pervasive use of mobile devices that would facilitate the uptake of mobile learning in developed countries. However, few researchers have looked into the potential use of mobile devices in learning environments in developing countries. To ascertain the extent of mobile learning in developing countries, this paper examines the current literature on mobile learning research in developing countries including projects, implementations, theories and conceptualizations of mobile learning for these countries.

Keywords: Mobile Learning, M-Learning, Characteristics, Developing Countries, Mobile Technologies, Learning Environments, Underprivileged Communities, Literature Review

Introduction

CURRENT LITERATURE INDICATES that most of the mobile learning theories and implementation trials have been carried out in the developed world. However, developing countries are in need of mobile learning research as the growth in mobile users and mobile technologies is significant, but these countries need to upgrade educational ICTs in order to progress (Barker, Krull et al. 2005). Traxler and Kukulska-Hulme (2005, 5) identify a number of problems that limit the adoption of mobile learning in developing countries, such as lack of uninterrupted power supply and poor computing facilities. To date, a number of mobile learning pilot projects have been tested in India, Kenya and South Africa. Results of these trials have been encouraging so far; learning environments-at elementary and higher education levels-in developing countries can utilize the potential of mobile learning for informal and mainstream education (Traxler 2009).

The purpose of this paper is to present a review of extant mobile learning literature which documents the research efforts in developing countries and underprivileged communities around the world. Unlike the research on mobile learning in developed countries, only a few research projects have been tested in developing countries. Developed countries spend

enormous sums on research to explore and test the integration of innovative technology in learning environments (Mifsud 2002). On the other hand, researchers in developing countries have limited access to the research grants to test mobile learning trails. However, there are few mobile learning research projects such as MobilED, accomplished by financial grants from Nokia and several other sponsors (Ford and Leinonen 2009). This paper will provide a snapshot of the current research on mobile learning characteristics in developing countries.

Definitions of Mobile Learning

Adoption of online learning or electronic learning by the education providers around the world has revolutionized the education industry in recent decades. Online learning has become popular as it offers flexibility and interactivity to learners and educators beyond the limits of time and space. The popularity of online learning extends to mobile learning as it not only inherits flexibility and interactivity from e-learning but also offers portability, connectivity, context sensitivity and collaboration. From e-learning, mobile learning is a step forward in achieving a higher degree of flexibility in learning (Low 2007; Peters 2009). Brown, Metcalf and Christian (2008, 1) discuss mobile learning as a window of opportunity for learning environments as they “invite the learning field to think ‘out of the box’ and take an evidence-based approach to exploring these capabilities” (Brown, Metcalf et al. 2008). In a traditional learning environment, availability of online learning and mobile learning resources and opportunities along with the existing face-to-face learning is often denoted with other terminologies such as blended learning and informal learning (Clough, Jones et al. 2009; Pieri and Diamantini 2009)

Mobile learning is a way to learn independently at anytime, anywhere due to advancement in mobile technologies (Kukulska-Hulme 2005; Ally 2009). O’Malley et al. (2003, 6) defined mobile learning as “any sort of learning that happens when the learner is not at a fixed, pre-determined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies”. The literature suggests that the popularity of mobile learning is not due to the advanced technology and use of mobile phones, but rather that the concept of mobility and learning has led to the notion of using mobile technologies in learning environments. Vavoula et al. (2002) discuss learning as a dynamic process as individuals learn, and are capable of learning, even when not in formal academic settings. Pachler et al. (2010, 6) define mobile learning as an additional learning forum in “life-worlds” of learners “Mobile learning-as we understand it-is not about delivering content to mobile devices but, instead, about the processes of coming to know and being able to operate successfully in, and across, new and ever changing contexts and learning spaces. And it is about understanding and knowing how to utilize our everyday life-worlds as learning spaces.”

Mobile Learning for Developing Countries

Technology-based learning for developing countries-countries with low per capita income according the Worldbank’s classification-is an ultimate solution to improve the educational standard. Infusion of technology in education may open new educational avenues particularly, for the people who do not have access to the traditional educational resources such as face-to-face learning and paper-based learning in case of distance learning (Gulati 2008; World-Bank 2011)

Educational ICTs are becoming fast, reliable, available in remote areas and affordable for everybody, particularly for underprivileged communities (Kim 2009). Gulati (2008), in her review of technology-enhanced learning in developing nations, further points out that in South Africa, distance education programs are being preferred over e-learning-based programs because of the cost of Internet connections in remote areas. Distance education students in Pakistan found that it was more convenient for them to access learning resources online than it was to be taught through satellite TV. Further, Indonesia, India and Bangladesh are also managing to provide education to the people of rural and remote areas by providing them with ICT support and introducing online degrees and courses.

These successful implementations of e-learning in education provide a sound basis for the introduction of mobile learning in developing countries. For the people of developing countries, mobile learning may help to eliminate certain barriers such as cost and slow speed of dial-up internet connections. It will be able to provide education to children in underprivileged communities, create cost efficient and more flexible learning solutions for those students who need to manage both work and study, and provide training to teachers using their mobile devices at a time and location convenient for them. Moreover, it can create awareness about diseases among the community (Traxler and Kukulska-Hulme 2005; Wains and Mahmood 2008). Traxler (2009, 17) emphasizes the emergent need for implementation of mobile learning in developing countries despite the limited ICT resources and relatively unstable infrastructure as compared to technologically advanced societies in the developed world. He states, "It is entirely possible that the emergence of mobile learning in developing countries will take the evolution of e-learning along a trajectory that is very different from that in developed countries, where it has been predicated on massive, static, and stable resources." A number of mobile learning pilot projects and studies have shown encouraging outcomes in developing countries. These results motivate further research and make a conceptual contribution to research into mobile learning for developing countries.

Research Methodology

The research method for this paper is a review of literature that focuses on mobile learning with special focus on developing countries. A literature review usually provides a picture of the state-of-the-art research in any discipline together with a critical analysis of the extant research in that discipline (Frohberg, Göth et al. 2009).

The literature on mobile learning abounds with research articles reporting conceptualizations and implementations in the developed countries. Unfortunately, there are few publications reporting research on mobile learning in developing countries. The aim of this literature review paper is to provide a snapshot of the status of such research in developing countries. Research articles on mobile learning in developing countries are presented in tabular form (see Table 1) followed by a short in-text discussion about these conceptualizations and implementations of mobile learning in developing countries.

The Literature Search

While undertaking the literature search, it was important to include important sources of relevant research literature on the topic. We focused mainly on online resources and therefore scanned for journal articles and conference papers through popular databases and books as

physical or printed resources. Since mobile learning is a multidisciplinary field of research, the literature includes contributions from researchers in diverse fields from the social sciences to engineering and information technology (Vavoula, Pachler et al. 2009; Pachler, Bachmair et al. 2010). As for the databases, those searched include: Science Direct, ACM Digital Library, Proquest (ABI-INFORM) and Springer Link. The research articles included within the scope of the literature search for this paper spanned those published from 2004 to 2009.

Filtering and Classification

Initially, the key term “mobile learning” was used, and subsequently pulled several thousand articles for mobile learning for developed and developing countries. From these results, filtering keywords were used such as “developing countries” and “underprivileged communities”. The number of articles was reduced to fewer than one hundred. A perusal of the articles’ abstracts found that few articles accurately reported on mobile learning research in developing countries. Those that did tended to be from peer reviewed journals, conference proceedings and book chapters.

Current mobile learning research is dominated by two main directions: i) conceptualizations and ii) implementations; therefore, each research article was classified based on its significance and the type of contribution it made to the knowledge base, whether conceptual or practical (see Table1).

Literature Review

Mobile Learning Implementations in Developing Countries

Most of the mobile learning research is being carried out in the developed world as these countries spend far more of their national budget on research, development and experimentation with new technologies in the educational realm (Mifsud 2002; Ambient-Insight’s 2008). Conversely, few research projects have been carried out in developing countries in this context. The lack of a research budget for educational ICTs is one of the factors which impede the mobile learning conceptualizations and implementations in developing countries. However, the literature shows (see Table 1) a number of implementations of mobile learning in developing countries including India, Kenya, Latin America, Africa, Indonesia and Pakistan. Although most of these implementations have been limited to the pilot projects and trials, early efforts show positive research outcomes in terms of participants’ motivation, added flexibility in learning environments, support in fieldwork and provision of learning resources to the underprivileged and indigenous communities and people in remote, hard to reach places via telecommunication networks. In addition, another aspect is that projects have been tested by vast numbers of students including elementary, K-12 and higher education participants. In addition, a variety of stakeholders such as students, teachers, educational administrators and IT managers have participated in these projects (Barker, Krull et al. 2005). Mobile learning research has been conducted across multiple educational disciplines such as medicine, business education, computer science and game based learning. Mobile learning is applicable to both distance education and traditional face-to-face learning; both of these modes have been included in the case studies of the developing world (Wains and Mahmood 2008).

Significance and Research Outcomes

Mobile learning research studies included in this paper have made a conceptual contribution to the knowledge base as well as indicating the practical implications for the education providers and key stakeholders such as teachers, students, instructional designers and educational administrators. Many of the researchers have conceptualized mobile learning for certain developing country's situation and formulated models and frameworks as research outcomes (Barker, Krull et al. 2005; Masters 2005; Wains and Mahmood 2008). Pilot projects and prototypes have also been conducted and tested for a variety of education levels and disciplines. Literature reviews, review papers and papers focusing on theory development have been examined for their conceptual significance. Moreover, publications reporting any implementations of mobile learning in developing countries such as running a pilot project, testing a prototype, other research projects using surveys, interviews or ethnographic research approaches have been considered for their practical significance.

Characteristics Considered

Researchers (see Table1) have considered a number of mobile learning characteristics in developing countries. However, few studies have focused on more than a few particular characteristics. Characteristics such as engagement, collaboration, communication and portability or flexibility have been considered by the participants of mobile learning studies in developing countries. Some researchers also investigated the cultural context of the country and its level of impact on the implementation of mobile learning in that particular country. The cost of the mobile internet and mobile devices was a matter of concern for the student population in spite of the fact that mobile internet services are significantly cheaper in the developing countries compared to developed countries. Research participants in the developing countries, particularly from indigenous and underprivileged communities, were unfamiliar with educational ICTs; therefore, they had concerns about the practicality of mobile devices for learning. Overall, most of the researchers found that learners in the developing countries were excited and motivated by the notion of using mobile devices for learning. In some countries, network connectivity was also a problem especially in remote and rural areas. Participants in developing countries needed technical support in order to switch from traditional learning and e-learning modes to mobile learning. They also needed assistance and initial training by the researchers in order to perform mobile learning activities.

Table 1: Studies of Mobile Learning in Developing Countries

Study	Brief description	Significance	Research Outcomes	Characteristics considered	Research method	Sample	Target Audience	Country
Barker, Krull, and Mallinson (2005)	Proposes a theoretical model for mobile learning adoption in developing countries.	Conceptual	Developed a model for the adoption of mobile learning in developing countries.	Portability, collaboration, motivation	Literature Review/ Model development	N/A	Key stakeholders from education sectors	South Africa
Facer K. et al.(2004)	Groups are supposed to communicate with each other while acting as lions in African Savannah.	Practical	Developed and tested a mobile learning game for school aged children.	Engagement, mobile gaming, tool to support learning	Pilot project/ Action research	Ten children aged 11 and 12	Elementary level school children	Sub-Saharan Africa
(Fotouhi-Gharzini et al.(2008)	Explores the potential use of mobile devices for learning in Iran.	Practical	Concluded that mobile learning is best suited to informal learning using surveys.	Usability, Cost, mobile learning activities	Surveys	181 high school students	School students	Iran
Ford and Leinonen (2009)	Examines the use of mobile devices in educational environment in developing countries.	Practical	Developed a set of guidelines for mobile device usage in and out of school for teaching and learning in developing world.	Cost, cultural contexts, collaboration, flexibility	Action research (Series of pilot projects called MobilED)	Students from elementary and middle schools and college	Schools and colleges from public and private sector	South Africa, India, Brazil, Finland
Gregson and Jordan (2009)	Explores the design and delivery of distance learning program to diverse range of students in developing countries.	Practical	Developed a model for design and delivery of distance learning in mobile learning mode along with the existing traditional distance learning and e-learning approaches.	Communication, access, engagement, collaboration, usability, flexibility	Case Study, Pilot project	88 Post-graduate distance learning students from South African region	Distance learning universities	Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zimbabwe, Zambia

Study	Brief description	Significance	Research Outcomes	Characteristics considered	Research method	Sample	Target Audience	Country
Kim, Miranda, and Olacregui (2008)	Examines the use of mobile learning technology to serve poor indigenous Latin American children.	Conceptual, Practical	Literature review of education inequality in Latin America; Pilot project named 'Pocket School' for indigenous children.	Mobile learning design considerations, cultural sensitivity, usability, applicability	Pilot project	Indigenous school-aged children	Elementary school level children	Latin America
Masters (2005)	'Low-Key m-learning' investigates the foundations of learning from traditional learning environments.	Conceptual, Practical	Developed a model for the process of transition into mobile learning, a pilot project has been tested in a university environment.	Contextualized, cultural context, pedagogy, mobility, communication, cost, ubiquity of technology,	Pilot project, surveys	2 nd and 3 rd year medical students	Medical students at undergrad level	South Africa
Oliver and Goerke(2008)	Examines university students' adoption of mobile devices for learning.	Practical	Observed students' use and adoption of mobile devices and Web 2.0 applications for learning	Convenience, connection, control, cultural contexts, technology adoption	Case Studies, Surveys	54 undergrad students	University students	Ethiopia, Malaysia
Sari and Tedjasaputra (2008)	Studies the potentials and challenges of mobile learning at school and university levels.	Practical	Identified potentials and challenges of mobile ICTs in education for Indonesia and Finland	Communication, collaboration, mobile learning activities, learning support	User-centered design, Ethnographic action research	650 students and 100 teachers	Students and teachers at school and college levels	Indonesia and Finland
Traxler and Kukulska-Hulme(2005)	Reviews the potential of mobile learning in developing countries.	Conceptual, Practical	Mobile learning implementation strategies and challenges for developing countries identified	Cost, usability, accessibility, content, connectivity	Case Studies	A university and a Software company	Population in developing countries	India
Wanis and Mahmood (2008)	Investigates the integration of mobile learning into e-learning in distance education system.	Conceptual, Practical	A framework proposed to integrate mobile learning into e-learning in distance education sector using case studies.	Mobile technologies, flexibility, access, personalized learning	Case study	Two distance learning universities	Distance learning universities	Pakistan

Research Methods and Sampling

Like the research on mobile learning in the developed world, a variety of research methods have been used in similar studies of developing countries (Vavoula, Pachler et al. 2009). Case studies, surveys, interviews, action research and ethnography were found to be the most popular research approaches among researchers (see Table 1). Most of the studies have been designed using multiple research methods such as case studies coupled with interviews or surveys. Many researchers have used surveys, interviews and observations to evaluate the research outcomes of the pilot projects or prototypes involving mobile learning. Elementary school pupils and secondary and university level students have been invited to participate in most of the mobile learning studies in developing countries. Several studies have also included other stakeholders such as teachers and certain educational administrators.

Conclusion & Future Research

In developing countries, mobile learning is considered at best as an informal and/or blended mode of learning which supports existing learning modes such as e-learning, distance learning and face-to-face learning. Despite the positive research outcomes of the early trials and pilot projects, there are vast challenges for researchers. These include lack of research budget, lack of advanced ICT resources in educational institutions, unreliable power supply, poor network connectivity and higher costs of sophisticated mobile devices. However, positive factors such as student motivation, lower costs of telecom services, flexible work and study options for students, educational opportunities for indigenous communities and government initiatives to upgrade learning-related ICTs, have made the issue of mobile learning in developing countries an interesting research challenge.

Research into mobile learning for developing countries is in its infancy. Future research is needed to explore the potential benefits of mobile learning for developing nations. Furthermore, researchers may need to investigate ways in which to address the challenges that currently impede mobile learning implementations in developing countries. Currently, the research is carried on to investigate the scope of mobile learning for a developing country in the higher education sector involving students, teachers and other key stakeholders in the learning environment. Furthermore, the researchers intend to undertake a more comprehensive literature review of mobile learning in developing countries by focusing on the publications from A and A* journals in the field of mobile learning.

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About the Authors

Umera Imtinan

Umera Imtinan is a PhD candidate in Information Systems at School of Information Systems, Faculty of Curtin Business School, Curtin University, Australia. Her research interests include study of Information systems: theory and practice, Learning management systems, Learning information systems, Social media learning forums, Mobile learning, E-learning, Educational technologies, Human computer interaction, Innovation and technology management. She did Masters in Computer Science from Punjab University College of Information Technology, Lahore in 2004; and began her career as Business Analyst; later on she joined COMSATS Institute of Information Technology, Pakistan as lecturer in Computer Science.

Prof. Vanessa Chang

Assoc. Prof. Vanessa Chang Associate Professor Vanessa Chang is currently the Dean of Teaching and Learning at Curtin Business School, Curtin University. Her research interests include Global IT Management, IT Governance, Business Process Management, Cloud Computing, and Green IT. In addition, her research interests also cover areas of e-learning environments, virtual worlds, and Web 2.0. She has experience in consulting and teaching in Information Technology Management, IT Planning, Business Systems Analysis, Object-Oriented Analysis, and Agile Development Methodologies.

Dr. Tomayess Issa

Tomayess Issa is a senior Lecturer at the School of Information Systems at Curtin University, Australia. In addition, she is a Postgraduate Course leader and Postgraduate Online Coordinator. Tomayess has vast experience in Australian tertiary education, teaching Usability and Human Computer Interaction, Social Network, Sustainability and Green IT, Networking and Operating Systems. Tomayess completed her doctoral research in Web development and Human Factors. As an academic, she is also interested in establishing teaching methods and styles to enhance the students' learning experiences and resolve problems that students face. Currently, Tomayess is teaching undergraduate and postgraduate units at the School of Information Systems focusing mainly on usability, human computer interaction, web 2.0,

web 3.0, sustainability and Green IT, Cloud Computing, networking and operating system. In recognition of her hard work and dedication, she received awards from the Curtin Business School and her school for her teaching. Tomayess participated in several conferences on Human Computer Interaction, Internet, teaching and learning, and published her work in several peer-reviewed journals. Tomayess is a member of an international conference program committee, and she is currently conducting research locally and globally in information systems, HCI, Usability, Internet, Sustainability and Green IT, social network and teaching and learning.

