Global Mobile Learning Implementations and Trends

Edited by

Avgoustos Tsinakos
and
Mohamed Ally

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Edited by Avgoustos Tsinakos and Mohamed Ally

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Acknowledgements

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Qatar Foundation: Qatar National Research Fund

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Athabasca University

Athabasca University is Canada's Open University dedicated to the removal of barriers that restrict access to and success in university-level study and to increasing equality of educational opportunity for adult learners worldwide. Dr. Mohamed Ally is a Professor at Athabasca University. He would like to thank Athabasca University for providing the resources to complete this book.

Foreword

Without question, the past decade has seen a surge in the number and types of physical devices that can support digital learning platforms. Where it was once possible to categorize devices into three broadly delineated "classes"—mobile phones, tablet computers, and desktop computers—the lines between these devices have shifted and blurred, and today technology that fits comfortably in a person's pocket or handbag can open a plethora of educational opportunities previously restricted to stationary technology.

In parallel with advances in mobile hardware, mobile connectivity has improved dramatically and is quickly becoming prerequisite for development. Data assembled by the World Bank (2009) shows that in low and middle-income countries a 10 percentage rise in broadband penetration adds a 1.38 percent increase in economic growth. While broadband is commonly understood as a "fixed-line" connection (and indeed relies heavily on fixed-line infrastructure), more people take advantage of broadband via wireless devices than tethered computers. According to recent estimates from the International Telecommunications Union (ITU) (2012), there are 1.2 billion active mobile broadband subscriptions worldwide, and for every one person who accesses the internet from a computer, two do so from a mobile device.

As mobile hardware and the networks that support them become more powerful, more dynamic, and more affordable, the mobility of Information Communication Technology (ICT) has, for good reason, become central to questions of teaching and learning. ICT in education studies have historically conceptualized technology as existing in two separate spheres—at schools and in learners' homes—but this dichotomous view is changing and does not fully describe how many young people use and conceive of technology. Today, learners are likely to have ICT with them constantly: at home, at school, on public transportation, at work, and, even in bed. Technology use is no longer, to a large extent, geographical constrained.

Because mobile devices have become ubiquitous in many communities, educational opportunities often hinge less on hardware than on connectivity. A prerequisite of many mobile learning opportunities is a fast and reliable data connection to the internet. The United Nations Educational, Scientific and Cultural Organization (UNESCO) and other organizations have recommended that governments work with relevant industries to build and augment the technological infrastructure that powers mobile devices and, by extension, mobile learning. It is also crucial that governments seek strategies to provide equal access to mobile connectivity, as well as hardware. A student who cannot use a mobile network is functionally denied access to an impressive and growing range of learning possibilities, even if that student owns a physical device.

Around the world, technology in education programs are pivoting away from a reliance on fixed line technology and incorporating newer and, typically, less-expensive mobile technologies, generally in the form of tablet or compact laptop computers. This shift is significant: mobile technology untethers learning from schools, expands opportunities for informal learning, and helps bridge in and out-of-school experiences. The chapter authors in this book are expert mobile learning practitioners who provide examples of mobile learning initiatives in different regions around the world.

While mobile learning projects exist in small pockets around the world, examples of large-scale programs that enjoy government support are few and far between. Thankfully, there are several notable exceptions. The governments of Thailand, Uruguay, Rwanda, to name only a few, have launched initiatives that seek to leverage mobile technology to accelerate progress toward Education for All. The initiatives are pushing the boundaries of technology in education forward and aim, in some instances, to not only improve, but transform decades-old models of education.

The emergence of large government-backed initiatives signals that mobile learning may be at a tipping point. While countries have previously shunned mobile technology in formal school systems, they are now embracing it. And for good reason: UNESCO's research reveals that there are numerous examples of successful implementations, and the sheer ubiquity of devices means that a one-to-one scenario (one student to one device), perennially elusive with desktop computers, is finally within reach, increasingly for poor as well as rich countries.

For these reasons UNESCO has put forth the following four policy recommendations:

- Take stock of existing ICT infrastructure and establish realistic targets for improving this infrastructure incrementally, devoting particular attention to underserved areas.
- Support the provision of robust and affordable mobile networks within and across communities, especially in educational institutions such as schools,

universities, and libraries.

- Consider providing full or partial subsidies for access to mobile data and broadband services. Many governments offer “e-rate” subsidies to promote internet access for educational purposes via computers. In addition, governments should now consider advocating for “m-rate” subsidies.
- Support efforts to build local and ad-hoc networks to support mobile learning, especially in settings where larger networks are unavailable.

Already mobile technologies have irreversibly changed politics, business, medicine and many other fields, often for the better. They have not yet had a massive impact on education, but as UNESCO’s research indicated (2012), it is not likely to stay this way. Mobile devices—because of their ubiquity and portability—are positioned to influence teaching and learning in a way that personal computers never did. Increasingly though, the educational promise of mobile devices rests less on access to devices themselves (this has, in many regards, already been accomplished thanks to the proliferation of mobile phones), but rather on affordable and widespread access to fast mobile broadband networks. A challenge of the next decade is expanding and improving the networks that power and will power mobile learning. The learning paradigm is fundamentally different from that which distinguished previous initiatives utilizing largely stationary technology.

The future of technology in education is wireless, and the initiatives described in this book are bounding toward this future. This publication provides an international review which easily translates into a practical roadmap for educationalists interested in mobile learning and an analytical mirror for practitioners already involved in mobile learning. As such, this resource is a valuable tool for all those who, as UNESCO does, see in mobile learning a window of opportunity for the expansion of educational opportunities and the transformation of learning.

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Agnieszka Palalas is a mobile learning specialist at George Brown College, Canada, where she has been in charge of numerous m-learning initiatives and research projects. She has worked with students and faculty to integrate innovative pedagogies and technologies in mobile and blended learning contexts. In her over 20-year experience as an educator, Agnieszka has also taught adults in the classroom and online, reviewed and designed curriculum, provided professional development, worked as a programmer and instructional designer, as well as led design-based research projects. Agnieszka holds a Ed. D. degree from Athabasca University. In her doctoral work, she concentrated on the effective design of mobile-assisted language learning solutions. Her other research interests focus on emerging approaches to teaching and learning, as well as formal and informal learning practice using innovative technologies. Agnieszka is active in local and international mobile learning and second language learning associations and is a regular presenter at professional conferences. She has published several articles pertaining to mobile learning. In her research of m-learning approaches and tools, Agnieszka has combined her expertise of instructional design and computer technologies with two decades of experience as a teacher and learner.

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Introduction

The current book in its **first chapter** provides an overview of the status of mobile learning and of the related initiatives, policies and barriers across the world. Under this light a variety of regions in the Northern and Southern Hemisphere are explored such as Europe, Russia and Ukraine, Africa and Middle East, Asia and Pacific etc.

On one hand, some areas are thoroughly examined as for example China in **Chapter 8** highlighting that even though mobile devices, such as the smart phone, laptop and tablets, are becoming popular in China, mobile learning is still in a beginning stage in China. Another area of interest is Alberta Canada discussed in **Chapter 12** where, for the purposes of this chapter, mobile learning in a K-12 context represents the opportunity for change within the public education system of Alberta, from traditional pedagogies of exclusion to one which embraces inclusive practice for all students.

On the other hand **Chapter 9** discusses the key challenges to widespread successful adoption of mobile learning, some early results they have experienced, and the potential for a real educational revolution from these personal, always-connected devices.

So this part of the book aims to provide an overview of the growth of mobile learning with emphasis on the educational sector and to report current trends, implications and the barriers related to mobile learning and concludes by comparing and categorizing the most important barriers towards the adoption of mobile learning.

Chapter 2 attempts a review of mobile learning in international development. It looks at the changing nature and expectations but starts by briefly exploring what the various terms might mean in this context before unpacking the issues behind the apparently simple ideas of using mobiles to deliver learning in international development.

Chapter 3 unfolds the topic of Universal Instructional Design Principles for Mobile Learning. It extends the analysis of universal instructional design principles in distance education, by applying them to the design of mobile learning. Eight principles with particular relevance for distance education are selected, and their recommendations are discussed in relation to the design of educational materials for a range of mobile devices. In the chapter relevant problems and opportunities of mobile learning are also discussed..

An extensive discussion takes place in **Chapter 4** regarding the planning for mobile learning implementation in large and small enterprises. The main topic to be answered in this chapter is related to the question: "How do we actually use mobile technology in the workplace to empower an enterprises' workforce?" Even though some large organizations have started using mobile technology training departments are still unsure how to design, develop and implement a successful mobile learning (mLearning) strategy that works for their organization.

Chapters 5 and 6 take a closer look at the application and the integration of mobile learning in education presenting a reflective overview of how the affordances of mobile tools combined with the ubiquitous character of m-learning and the nomadic tendencies of mobile learners open up new territories of knowledge construction. Five conceptual spaces of mobile learning are identified as the essential elements of the m-learning ecosystem, including (1) temporal, (2) physical, (3) transactional: intrapersonal, personal, and interpersonal (social and public), (4) technological, as well as (5) pedagogical spaces.

Chapter 6 discusses in detail the evolving field of mobile learning—its definitions, perspectives, strategies for teaching and learning—and provides suggestions for adapting instruction to meet the needs of mobile learners. Furthermore, it also places a well pointed question: "How much do we really know about and integrate these tools and strategies in our teaching?"

Three specific mobile applications are discussed in the subsequent chapters. **Chapter 7** explores how the massive open online course (MOOC) format developed by connectivist researchers and enthusiasts can help analyze the complexity, emergence, and chaos at work in the field of education today. This is attempted through the prism of a MobiMOOC, a six-week course focusing on mLearning that ran from April to May 2011.

Location-Based Learning with mobile devices is explored in **Chapter 10.** The location-awareness characteristic of mobile devices added the essence of sensing and reacting based on location-based environments to the location-based mobile learning environments that use mobile devices. In this chapter the exciting concept of location-based mobile learning using the learner's mobile device is brought into light. The so called 5R adaptive framework and the Augmented Reality integration in location-based mobile learning are highlighted in order to provide some leading guidelines for recognizing location-based learning practices and effective pedagogies incorporated in a particular “learning space” with the support of mobile devices.

Chapter 11 discusses the use of mobile microblogging and applies a mixed-method design to explore how to promote learning in authentic contexts in an online graduate course in instructional message design. The students used Twitter apps on their mobile devices to collect, share, and comment on authentic design examples found in their daily lives. The data sources included tweets (i.e., postings on Twitter), students' perceptions about mobile microblogging activities, and self-reported Twitter usage.

Finally two successful cases of mobile learning implementations are reported. The first one provides a snapshot of Teachers' Explorations in Mobile Learning Implementation in Hawaii's Public Schools where the teachers explored the possibilities of integrating mobile learning in class and the ways to create effective 21st century learning environments (**Chapter 13**). The second one (**Chapter 14**) assesses the self-efficacy of nursing faculty and students related to their potential use of mobile technology and asks what implications this technology has for their teaching and learning in practice education contexts, involving students and faculty in two nursing education programs in a western Canadian college in January, 2011.

Professor Avgoustos Tsinakos
Professor Mohamed Ally

1

State of Mobile Learning Around the World

Avgoustos Tsinakos

Abstract

The current chapter summarizes the status of mobile learning and of the related initiatives, policies and barriers across the world and it is divided in two sections according to the geographical location of the corresponding regions. Therefore, the first section will concern the Northern Hemisphere and the regions of Canada, the USA, Europe, Russia and Ukraine, while the other section will concern the Southern Hemisphere and the regions of Latin America, Africa and the Middle East, Asia and the Pacific.

The current chapter aims to provide an overview of the growth of mobile learning with emphasis on the educational sector and to report current trends, implications and the barriers related to mobile learning. The chapter concludes by comparing and categorizing the most important barriers towards the adoption of mobile learning, and poses some required recommendations and reformations on policies, on perspectives and on educational programs in order for the spread of mobile learning to be facilitated.

Introduction

Although the concept of mobile learning is gaining popularity around the world as the widespread use of mobile devices and of smart phones facilitates this trend, large scale projects of mobile learning are rare. Most of the projects are university or school-based initiatives, while some others are supported by local authorities, provinces, the private sector and industry.

A closer view of the projects that were reviewed reveals that they fall in one of the categories below:

a. Organization provided devices (OPD) projects, where a university or a province or a company takes the complete responsibility for the project's cost.

b. Shared cost provided devices (SCPD) projects, where the cost of the device or the communication cost is shared among the organization and the learners.
c. Free of cost projects, also known as Bring Your Own Device (BYOD), where the cost is shifted to the learners who can participate using their own mobile device.

Restrictive educational policies, economical barriers and personal fears act as roadblocks against the adoption of mobile technologies for educational purposes. Since mobile technologies are increasing in prevalence, quality and affordability, there will be increasing pressure for education to adopt mobile technologies in the learning process.

The current chapter will review the status of mobile learning in regions located in the Northern and the Southern Hemisphere such as Canada, USA, Europe, Russia and Ukraine, Africa and Middle East, and Asia and Pacific.

Section 1 Mobile Learning Around the Northern Hemisphere, a Closer Look

In the current section a comprehensive analysis of the use of mobile learning will be attempted, surveying similarities or discrepancies that appear in the regions located in the Northern Hemisphere. It aims to provide an overview of the growth of mobile learning with emphasis on the educational sector, in order to identify common initiatives, new emerging policies and perspectives for education, similar barriers and potential solutions which might facilitate the use of mobile learning globally

Canada

Proliferation and Penetration of Mobile Devices

The penetration of mobile devices has remarkably increased over the last two years (Hardy, 2012). According to the Canadian Wireless Telecommunications Association Canada's wireless carriers offer coverage to more than 99% of Canadians, while the combined subscriber number surpassed 26 million with the prediction that 30 million Canadians will have a wireless device by 2014. According to Bernard Lord, President and CEO of the CWTA, "wireless penetration in Canada is set to exceed 100% in just the next few years" (Hardy, 2012). As of December 2011, 45% of mobile subscribers in Canada have smartphones (Iab.canada, 2012) and their adoption is expected to cover the

50% of the Canadian market for 2012 (Duong, 2012, p. 49).

Review of Mobile Learning Initiatives

A number of mobile learning projects are conducted in Canada promoted by educational institutions, companies or even by the provinces. As typical examples, the province of Ontario has legislated the use of assistive technology for students with identified special needs and the province of Alberta is developing a guide to the meaningful use of mobile technologies in schools. In addition, in Manitoba the Manitoba's Literacy with ICT Across the Curriculum initiative mandates that teachers develop their students' ability to think critically, creatively and ethically with information and communications technology (ICT), including mobile devices (Fritschi and Wolf, 2012, pp. 14-15).

Apart from these initiatives driven by the provinces in Canada, some universities also conduct mobile learning projects. Most of them are included in the recent report of Ally and Palalas (in press) which tries to identify, among other issues, how Canada is positioned globally in terms of mobile learning.

According to this report, Athabasca University has conducted a number of mobile learning projects such as a project with the Athabasca University Library which has developed mobile accessible websites to enable the students to access material and research resources from their mobile devices. Another project called "the English project" was designed to explore the effectiveness of mobile devices towards the development of English language skills employing innovative approaches to mobile-assisted workplace language training. The University also offered access via mobile devices to other courses such as Mobile French and a Nursing and Health Studies Web (AU Mobile Strategy Report, 2010). Finally a mobile-friendly Digital Reading Room was created to enable students to access their course readings, and mobile language websites via their mobile devices (Ally and Palalas, in press). These projects have followed the BYOD approach and resulted in quite encouraging conclusions for the use of mobile learning (Kenny, et al., 2009).

Similar to Athabasca University, George Brown College employed the use of mobile devices following the BYOD model in order to enrich interactions for the English as a Second Language (ESL) and Communications classes. The project aimed at the provision of language practice outside the college and resulted in positive concluding findings.

At the University of British Columbia, as stated by Macdonald and Chiu, the mobile delivery of course content was found to offer increased convenience and flexibility to the participants, concluding that the most effective format for presenting mobile content is video, followed by audio and text (Macdonald and Chiu, 2011).

The Algonquin College has also adopted the BYOD approach as 80% of Algonquin College students bring their own mobile devices to the college such as laptops, iPads, smartphones, or notebooks and this trend continues at an increasing rate. In order to meet the increasing need for mobile access of the course content the college has opened the Algonquin Mobile Learning Center, providing a dedicated space to use mobile computing devices facilitating also collaboration among the students. Additionally the college has also started a pilot project called "myDesktop" service that remotely delivers computer applications (such as Microsoft Office, AutoCAD, etc.) to a student's mobile device (Algonquin College, 2011). A similar initiative has been adopted by Durham College and the University of Ontario Institute of Technology (UOIT) in Oshawa (Durham College, 2011).

In the Wilfrid Laurier University the success of another BYOD pilot project conducted for the MBA program has led the university to incorporate mobile technology into its current full-time MBA program. During the pilot students and faculty participating in the program interchanged course material, assignments, presentations etc., using their mobile devices (Johnson, et al., 2011).

Close to the mobile initiatives in Ontario, a research project conducted by Rhonda McEwen at the University of Toronto examined whether devices like iPads could facilitate communication and interaction for autistic children (Hewitt, 2011).

As reported by Ally and Palalas, "a number of projects have also been housed at Ryerson University, OCAD University, University of Waterloo, Conestoga College, Seneca College, McGill and many other Canadian schools" (Ally and Palalas, in press).

Even though mobile learning projects are gaining popularity in Canada, a number of roadblocks are slowing down their adoption.

Policies, Implications and Barriers to Mobile Learning

The increasing spread of mobile devices and of smart phones does not necessarily imply to their adoption in education. Ally and Palalas claim that the Standards Council of Canada is working with an international technical committee [ISO(International Organization for Standardization) and IEC(International Electrotechnical Commission)] to develop a technical report on Learner Information Model for Mobile Learning (Ally and Palalas, in press). As Volante and Jaafar indicate, Canada does not have a national ministry of education. Therefore the federal government does not play a significant role in determining education policies in all the thirteen provinces and territories which belong to the Council of Ministers of Education of Canada. The latter is an intergovernmental body that provides education leadership at the national level (Volante and Jaafar, 2008). Therefore most of the mobile initiatives are conducted following local control of education polices (i.e. of the provinces and territories). Such local policies—District Acceptable Use Policies—could have a profound positive or negative impact on mobile learning (Fritschi and Wolf, 2012, p. 16).

Due to the lack of specific educational policy a number of barriers to mobile learning implementation and practice arise as Ally and Palalas report in their research in Canada. The high startup cost of mobile learning initiatives—especially when they do not follow the BYOD approach in relation to the cost of bandwidth and or the absence of appropriate network infrastructure were among the top roadblocks that emerged.

Many hesitations also arise in the school or even in the university environment related to students' security and privacy issues. In addition, some of the commonly reported arguments in the above mentioned environments concerns the fear of employing a destructive—for the students—technology.

Resistance from the teachers (due to lack of expertise or lack of resources for development and support) in addition to fears arising from the students' parents resulted in many cases in policies and regulations which prohibit or exclude mobile devices in schools (Ally and Palalas, in press). Limited access to the technology by disabled students is also an issue to be considered.

On the other hand, Canadian managers and other stakeholders are still skeptical about the use of such technology for educational or training reasons as mobile learning is in its infancy stage.

Although Ally and Palalas' findings indicate that Canada is considered to be an "Early majority" according to Rogers definition (Rogers, 1962) as regards the adoption of mobile learning, the above mentioned issues still hamper the widespread adoption of this educational method.

USA

Proliferation and Penetration of Mobile Devices

Mobile phones and smartphones are very popular in USA. This trend is verified by the statistical numbers of the proliferation of mobile technologies. In USA, mobile phone subscribers totaled 331.6 million in early 2012, indicating an amazing penetration rate which equals 104.6%. (Ctia.org, 2012). It is estimated that more than 110 million people in US owned smartphones during the three months ending in June 2012, up 4% versus March 2012, according to Internet analytics of comScore. Furthermore, 234 million Americans age 13 and older used mobile devices for the three-month average period ending in April 2012, according to comScore, Inc. with the estimation that 107 million people owned smartphones during the same period, up 6% versus January 2012 (New Media Trend Watch Asia-Pacific, 2012). This high rate of proliferation of mobiles provides a great opportunity for the development and implementation of a variety of mobile projects. Although the USA government has initiated several national programs of mobile learning projects, many programs tend to be school-based while a number of state and provincial programs also exist.

Review of Mobile Learning Initiatives

Mobile learning programs in the USA tend to either provide mobile devices to students directly (OPD) or to allow students to bring their own technology (BYOD) given that 75% of teenagers have mobile phones (Wallace, 2011; Madden, 2011). As the national educational policy emphasizes increasing the equity and reducing the gaps between students of different demographic and economic backgrounds, some initiatives are following a hybrid approach of shared cost projects (SCPD).

Fritschi and Wolf in their paper, on behalf of UNESCO, report some of these initiatives. In the list of the OPD mobile projects conducted in the USA, the Qualcomm's Wireless Reach initiative (started in 2006) is one of the longest-running mobile learning initiatives which, in addition to the FCC's Learning On-the-Go pilot program (started in 2010), provide external funding to encourage and support district mobile learning initiatives. "The initiative's education projects aim to increase student access to educationally relevant content and enable communication with teachers and peers through online tools and resources for 24/7 learning" (Fritschi and Wolf, 2012, p.17).

As a part of the Qualcomm's Wireless Reach initiative North Carolina's Project KNect (started in 2007) provided smartphones to students with low end of grade math test scores as a way of increasing their engagement and math achievement. After the encouraging project results—end of grade test scores were increased at a rate of 30% comparing to the scores of other students with no access to mobile devices—the program was extended under the FCC funding (since 2011) to also include other states such as Virginia and Ohio.

At this time, the FCC's Learning On-the-Go program supports twenty districts in fourteen states providing the necessary funds for purchasing a range of devices such as tablets, smartphones, netbooks etc. As a typical example the Katy Independent School District in Texas received funding to develop a program in which students and teachers will have smartphones to interact while the teachers will use a learning management system to create and manage assignments. In addition, the Greater Southern Tier Board of Cooperative Educational Services which supports twenty-one districts in New York received a grant through the FCC project for the utilization of a virtual classroom software program by providing smartphones and netbooks to middle and high school students (FCC, 2011).

Forsyth County School District in Georgia has adopted the BYOD approach with a pilot program which has started with a small number of schools and expanded afterwards to twenty schools. According to the project, students were allowed to bring their own mobile devices in school as part of the everyday teaching/learning process. On the other end, the program provided teachers with job-embedded professional development and instructional support from media specialists in each school. Project findings indicate that "in order to achieve positive results districts and schools must employ a systemic approach that appreciably changes teaching and learning as a whole" (Fritschi and Wolf, 2012, p. 22).

Projects of shared cost provided devices (SCPD) are mainly adopted by primary schools as younger children are less likely to have their own mobile devices. On the other hand, in some districts schools and universities may use a combined approach to mobile learning in which they fund part of the cost of the device and the required access plan, while students or their parents are responsible for covering the remaining expenses. As a typical example, Saddleback Valley Unified School District in California has conducted a SCPD project where mobile devices have been purchased from the institute on behalf of students in elementary school. Furthermore, some other SCPD projects are targeting students belonging to low income families or in other cases some companies are beginning to offer reduced rates or shared plans, in which parents and districts split the costs of the mobile project.

In the private sector initiatives like the Text4Baby projects have followed the SCPD approach. Text4Baby brought together several partners such as the U.S. Department of Health and Human Services, the National Healthy Mothers/ Healthy Babies Coalition, Johnson & Johnson, mHealth provider Voxiva, and the foundation arm of CTIA in order to share the cost of texting over 20 million SMS messages to parents (Gahran and Perlstein, 2012, p. 10).

Policies, Implications and Barriers to Mobile Learning

The National Broadband Plan, developed by the FCC in 2009, and the plan of Transforming American Education: "Learning Powered by Technology" by the National Educational Technology Plan released in 2010 is the main plan in USA which contributes to the adoption of mobile learning in education. Both plans emphasize the role of technology as a facilitator to students' education and the provision of educational opportunities and content available on the internet (FCC, 2009). Furthermore, the Association of Secondary School Principals issued a policy which encourages administrators to use mobile technologies for teaching and learning in schools, and to focus on teaching students how to use internet resources (NASSP, 2011a) and mobile and social technologies effectively and safely (NASSP, 2011b).

It is worth mentioning that a set of Common Core State Standards (CCSS Initiative, 2010) was adopted for the development of digital content, courses and resources by the District of Columbia and forty-six other states. Such policies remedy the problem of content and resource development due to the multiplicity of operating platforms available in the field of mobile learning.

State, provincial and local policies also exist in the USA affecting critically the facilitation or the prohibition of mobile learning in their areas (Fritschi and Wolf, 2012, p. 15). The adoption of directions such as the Legal Appropriate Responsible and Kind framework so called LARK in everyday educational plans, or of the Cell Phones in the Classroom: A Practical Guide for Educators (Kolb, 2011), can result in potential hesitations raised by some districts or by some school principals or teachers as regards the use of mobile devices in the school environment (Livingston, 2006). Such hesitations are grounded to the existing barriers which affect negatively the adoption of mobile learning. Such barriers concern:

There is high startup cost of OPD programs. Students could become frustrated as they may have to shift from their own mobile device to a new one due to the project's requirements. The misuse or the loss of mobile devices is also cumbersome for OPD projects. Equity issues among students' ability to access smartphones due to low income or due to social-demographic origins, might arise as part of a BYOD project. Lack of specific educational plans or guidance both for teachers and students on how to use their personal devices for educational purposes in combination with a lack of appropriate broadband resources within the schools or the districts may also prohibit mobile learning activities.

Additional findings from the mobile learning projects in the USA indicate hardware limitations, such as small screens of the mobile devices, or their use by students with disabilities as a potential drawback. As reported by Wallace students' distraction in class might be a critical concern that has led many districts to exclude mobile devices from the school environment (Wallace, 2011). Exposure of students to risk environments containing inappropriate material, or to hostile behaviors such as cyber bullying, sexual offenses, or potential cheating during school's examinations are some additional roadblocks towards the adoption of mobile learning in the USA.

Europe

Proliferation and Penetration of Mobile Devices

Mobile phones are widely used in Europe. By the end of 2011 a total of 741 million mobile cellular subscriptions have been estimated in the European region indicating a penetration rate of 119.5% (ITU, 2011). Though, as reported by Dylan Bosomworth D. "The latest data (collected May 2011) suggests that mobiles are not used as widely as might be expected, given the hype, for different web applications across Europe" (Bosomworth, 2012). Smartphone penetration rates are also controversial in the EU from the high rate of 75% in Sweden to the low rate of 9% in Romania and Bulgaria (Export.gov, 2012) while the average penetration number among the EU countries is estimated at the level of 34% which is increasing yearly.

Considering the demand by European Commission for the countries' economies to remain competitive and innovative, according to the EU's Europe 2020 growth strategy, the high rate of proliferation of mobiles provides a great opportunity for European countries to work towards their above targets. The integration of ICT into European education systems is seen as crucial to enhance the European economy (EACEA/Eurydice, 2011).

Review of Mobile Learning Initiatives

Mobile learning initiatives in Europe are primarily funded by European Commission through the Framework Program for Research and Development (FPs) (CORDIS, 2011). European mobile learning initiatives apart from being EU-funded are also nationally, locally, or privately-funded. Jan Hylén (2012) in his paper, on behalf of UNESCO, reports some of the most important initiatives in EU. The projects described below have been supported by EU-funds.

The HandLER was an SCPD project launched in 1998, which aimed to develop mobile devices and methodologies to facilitate lifelong learning in varying contexts. However, the technology available had severe limitations and

the project succeeded on establishing requirements for mobile technologies.
Similarly the MOBIlearn was a BYOD project which ran from 2002 to 2005 to enhance blended learning in MBA programs, to improve learning opportunities in museums and galleries, through mobile devices and to deliver medical knowledge via mobile phones in emergency situations. The project succeeded on establishing the viability of hand-held technology to enable learning in informal settings (MOBIlearn, 2005).

The eMapps program followed the BYOD approach and ran from 2005 to 2008 aiming to build communities where children would create digital content about their culture, communicate with peers and help integrate ICT into education (eMapps, 2008).

The M-learning was an EU-funded OPD project, coordinated by LSN, a now-defunct non-profit organization dedicated to improve education in the public and private sectors in the UK. The project facilitated disaffected learners, by engaging them in learning outside formal school settings. In this project, mobile learning functioned best as part of a "blend" of learning activities, rather than a single solution.

The list of EU-funded projects can be further completed by other two initiatives. Maseltov (Maseltov, 2012) is a collaborative multi-partner SCPD project, which runs from 2012 to 2014 and focuses on developing computing services on smartphones for immigrants. The second is the pan-European xDelia project, which ran from 2009 to 2012 and focused on delivering new approaches to decision-making research based on wearable sensors and serious gaming technology (xDelia, 2012).

The United Kingdom implemented nationally funded projects for mobile learning. MoLeNET which followed the SCPD approach was the largest and most diverse mobile learning initiative in Europe. It ran from 2007 to 2010 and was coordinated by LSN. It defined mobile learning technologies to support teaching and learning and it facilitated student retention and lower drop-out rates. MELaS adopted the BYOD approach and ran from 2007 to 2008, and was funded by JISC, a government agency which funded a number of other similar projects in the UK. The MELaS developed an SMS network in which students and faculty of the University of Wolverhampton would engage in text conferences (MELaS, 2012).

Nationally funded mobile learning projects adopting the SCPD approach were also implemented by the Netherlands. The SURF foundation funded two mobile learning projects in the environmental sciences. First, the GIPSY program, which ran from 2002 to 2003, was a good example of integrating practical field work through mobile devices with classroom activities and

Manolo project which ran from 2004 to 2005, focused on the integration of electronic, wireless and mobile learning (Alterra, 2011). The SURF supported the ARena project which was focused on Augmented Reality (AR) targeting students who were asked to use their smartphones' camera to investigate their surrounding environment. Unfortunately, as user interaction was not yet perfected, the educational use of ARena was not as successful as expected (Ternier, et al., 2010). Though, the first encouraging signs for the use of AR in education were indicated in the Spring School on mobile learning in higher education, which was organized by SURFacademy in cooperation with the Centre for Learning Sciences & Technologies in Heerlen during May of 2009 (CELSTEC, 2009).

Denmark invested almost one million Euros as governmental funding to support a variety of mobile learning pilot projects between 2005 and 2006; however, there are few published evaluations of these projects (Hylén, 2012, p. 19).

Other European countries report scattered activity on mobile learning, through the local and privately funded projects. The LET'S GO was an OPD program which ran from 2008 to 2011 and was funded by private resources in Sweden and the USA. Schools in Sweden and the USA collaborated in an interactive learning platform to share research questions and data. The PI program in the UK has adopted the SCPD approach. It took place from 2007 to 2010 and facilitated inquiry-based learning and supported learning across formal and informal settings (Sharples and Scanlon, 2011). The Learning2go program which started in 2003 in the UK is also inquiry-based and claims to be the largest collaborative mobile learning project for students. However, an overall project evaluation is not yet available. The Nintendogs was an SCPD project, which ran in 2008 in Scotland, and was small-scale, game-based and designed by teachers in two Primary 2 classes. Students developed writing, technological and social skills by composing stories about their dogs and calculating skills to make budgets.

Other initiatives include: (1) an OPD project which was implemented in 2009-2011, in Switzerland, was school-based and students were given an Apple iPhone 3G as part of their personal learning environments(PLE), (2) In Bergen, Norway, tablet devices and e-readers have been used to motivate boys (bt.no, 2011) adopting the OPD approach, (3) In Denmark, private educational publishing companies requested school subscriptions for accessing digital learning materials via mobile devices adopting the SCPD approach.

National funded initiatives also took place in Greece adopting the SCPD approach. During the period of 2009-2010 Kavala Institute of Technology

(KIT) provided SIM(Subscriber Identity Module) cards to more than 150 staff members in order to use them in their mobile devices to access internet and institutional services via Virtual Private Network (VPN). Since October 2012, “The University Mobile Internet” is a national SCPD project which provides wireless connectivity via 3G networks up to 4GB of data exclusively for students, faculty and staff of the Greek universities and colleges. The target population who will be eligible to participate in the project is estimated to be 295,000 students, 29,000 MSc and Ph.D. students and 20,000 university professors. (GRNET, 2012; Giannikopoulou, 2012)

McQuire in his report (McQuire, 2012) summarizes some of the most important private funded MOBILE projects. Brent Council is a local authority representing an area of London in the U.K. The council has approximately 3,000 employees and approximately 1,000 laptops, 800 BlackBerrys in addition to a small number of tablets. The Council deployed a BYOD program in order to provide mobile applications to the employees who requested to go paperless and to use mobile devices in their work environment.

Similarly, Leeds City Council, the second largest local authority in the U.K., employing around 33,000 individuals, provided a number of mobile applications to its employees, following the BYOD approach which has been also adopted by Honda in France who decided to deploy iPads and focus its strategy on mobile applications.

Finally, AWD, a Germany-based financial advisory firm operating in eight countries also adopted the BYOD approach in order to roll out an enterprise mobility management solution for over 1,000 users enabling them to easily self-enroll to apply for security credentials and distribute company applications.

Policies, Implications and Barriers to Mobile Learning

Mobile learning is not mentioned among the priorities of the Ministries of Education in Europe (Lewin, etc,, 2011). However, in the UK, Denmark and the Netherlands policy-makers have addressed some strategies. The UK was the most active country in Europe in the field of mobile learning from 2000 to 2009. The government initiated mobile learning programs in primary and secondary education and universities and cooperated with telecommunication companies to provide mobile technology to students. Considering these previous projects and the fact that smartphones and tablet devices are becoming cheaper, the UK provides fertile ground for bottom-up initiatives.

On the other hand, the Netherlands has no national strategy; however, there are promising efforts in primary, secondary and tertiary education. Kennisnet, a semi-governmental organization supports the government to promote mobile learning, through issuing guidelines concerning ICT, working with the SURF foundation to stimulate the use of mobile technology and organizing the "Make it mobile" contest to motivate students and scholars to develop mobile educational devices. However, the use of mobile technologies is described as low and the government does not plan to make mobile learning a policy priority in the near future.

Denmark includes mobile learning directions in its national policy documents. In 2009, guidelines on mobile learning had been published by the government's national e-learning center and the Danish web portal for teachers and students contains pedagogical advice on mobile learning. In 2011, the Digital Path to Future Welfare ICT strategy calls for an investment provided by the state and Danish municipalities, on developing digital materials and mobile platforms, pushing to establish a market similar to "app stores" for smartphones and tablet devices.

As it seems, mobile learning in European education requires still a long way. The existing barriers are the lack of policy support and governmental investment and the negative social attitudes of people towards mobile phones in the school environment (i.e., in Italy, Greece, UK) because of cheating, cyber-bullying, etc. However, the low cost of devices, their growing functionalities and the proliferation of powerful hand-held devices may be drivers to increase the implementation of mobile learning. Acquiring a BYOD approach will promote mobile learning as the current economic crisis reduced investments in ICT for education. The challenge for policy-makers will be to create guidelines that will not be restrictive as technologies and pedagogy are constantly transforming in response to development. Successful projects should also balance infrastructure, competence development, digital learning materials and pedagogical vision (ten Brummelhuis and van Amerongen, 2010).

Russia and Ukraine

Proliferation and Penetration of Mobile Devices

Russia has always been a great market for cell phone producers and telecom companies. As in many other emerging markets, mobile usage has exploded in the last 10 years. The number of mobile phones in Russia has doubled in the last 6 years. Today 90% of the Russian population owns a mobile phone. According to TNS, in January 2012, a variety of mobile devices to access the network is used by more than 22% of all people in large Russian cities. At a rate of 51% Russians use regular cell phones to access the internet via mobile networks, 43% use smartphones and the remaining 6% use tablets. Though there is a variation in Moscow, as smartphones are more often used to access the internet at a rate of 56% while 31% of Moscow uses regular mobile phones for this purpose and 10% uses tablets (Yandex and TNS, 2012).

According to forecasts of the researchers, by 2013 the volume of selling of tablet computers will reach 1.23 million per year and of the smartphones will reach 15 million compared to 2010 where 3.9 million and 400,000 were sold respectively. Thus, in 2013 a 36% of all phones sold in Russia will be smartphones and their average cost will decrease from the current $350 to $285 (Russian Search Tips, 2012; Zapuskalov, 2012).

In Ukraine, the number of cellular subscribers for the second quarter of 2012 increased compared to the first quarter of 2012 by 1.6%—up to 54,867,731 (number of SIM cards), according to the analytical report consulting company Advanced Communications & Media (AC & M). The level of mobile penetration in Ukraine as of June 30, 2012 was 120.4% compared to 118.5% at March 31, 2012 (RBK nd., 2012).

As of June 30, 2012 the number of mobile subscribers accessing the internet in Ukraine was 14.1 million people, of which 11.6 million-2G-users [GPRS (General Packet Radio Service)/ EDGE(Enhanced Data Rate for GSM Evolution)] and 2.5 million-3G-users [CDMA EV-DO; UMTS(Universal Mobile Telecommunications System)].

Review of Mobile Learning Initiatives

At present, mobile learning in Russia and Ukraine is not widely developed as only few initiatives can be identified in the private and academic sectors (Golitsyna, 2011; Bugaychuk, 2012; Slavic-Greek-Latin Academy, 2012).

One of the first efforts for mobile learning in Russia with positive outputs was an OPD project which was held during the period October to December 2007 by Medium company and Beeline mobile operator. In this project a mobile training course called “credit sale tariff plans for individuals” was designed and delivered to 30 employees who used a PDA HP IPAQ hx 2790 device (Websoft-elearning, 2008).

An interesting effort, not in the form of a mobile learning project but rather as an effort to familiarize students with mobile learning, took place in the schools of Ukraine during December 2009 to February 2010. A mobile operator Mobile Tele Systems (MTS) in cooperation with the Ministry of Education, the Ministry of Finance, and the Ministry of Youth and Sports created a series of “mobile” lessons focusing on modern means of communication, wireless phones and safety issues. The lessons have reached more than 4,000 students of the middle classes in 146 Ukrainian schools. According to Dr. Volobuyev

Dean of Donetsk Oblast Institute, this mode of training would be used in the future to cover the training needs of teachers and professors in Ukraine either in the form of mobile or distance education or utilizing self-training opportunities (NAU nd., 2011).

Similar initiatives have been held by the company named “Young Digital Planet” who developed a number of e-learning courses compatible with a variety of mobile devices, on the topics of mathematics, physics, chemistry, biology and science for pupils aged 10 to 19 years. A learning platform was also offered in order to facilitate the use of the courses and meet the learning preferences of individual users (Young Digital Planet nd., 2012).

The Moscow Institute of Technology and Slavic-Greek-Latin Academy follows the SCPD approach as its students during their admission to the Institute are granted with an android tablet in order to further enable their access to all training materials and tests available in the Academy’s LMS. Furthermore, the tablets can also be used by the students for communication purposes such as chatting with peers and academic staff or for participating in webinars held by the Institute (Slavic-Greek-Latin Academy, 2012; MTI nd., 2012).

In the private sector, the nonprofit organization Community e-learning PRO provides a series of educational activities on mobile learning. For example, in August 24, 2012 a webinar on the use of QR codes for teaching, learning, and other professional activities was held, covering both areas of Russia and Ukraine (Litvinova, nd., 2012b).

Policies, Implications and Barriers to Mobile Learning

Mobile learning has created a positive impact in Russia and Ukraine according with the general views of the regional scientific population (Golitsyna, 2011; Litvinova, nd., 2012a). The ongoing growth of use of mobile devices such as phones, laptops, PDAs, tablets, e-readers, etc. for educational and training purposes is an encouraging indicator.

Mobile learning is currently considered as an alternative method of e-learning and embodies the principles of open education: flexibility, modularity, time and place independency, and the use of modern communication technologies. Despite the positive perceptions towards mobile learning in Russia and Ukraine, a series of roadblocks have to be removed.

On the infrastructure level, internet coverage has to be improved mainly in the rural areas. It is worth to mention that in Ukraine only one operator is licensed for 3G, as other mobile networks operate in the standard CDMA 2000, covering only small areas such as big cities or trading centers. Furthermore, educational institutions are hardly supported by wireless networks.

Limited resources of fully functional and of high quality educational content for mobile devices are an additional barrier to mobile learning, which is further expanded considering the lack of specific technical programs to train educators and trainers in the field of mobile content development. Furthermore, large number of standards, variety of screen sizes and operating systems and limited means of content development blurs further the landscape of mobile learning.
As reported by Konstanine Bugaychuk, another critical barrier in the establishment of mobile learning is the lack of research data at a national level from the evaluation of mobile learning initiatives, as such evaluation techniques are in early stage in the region.
The parameter of cost should not be overlooked, as the independent user is related both to the cost of the device as well as to that of mobile internet. Even in the school environment, the low level of funding prohibits the development of high quality wireless networks to support mobile learning initiatives. Therefore, the most popular approach to implement mobile learning is a centralized purchase of mobile devices from a manufacturer, but the low level of funding forces the students to use their own devices in the educational process and the BYOD is the most popular approach followed by the SCPD (Bugaychuk nd., 2012b).
Additional findings indicate hardware limitations such as small screen's sizes of the mobile devices, and limited battery life, although at present the proliferation of tablets, smartphones and netbooks in the Russian and Ukrainian population tends to remedy this deficiency.

Section 2 Mobile Learning Around the Southern Hemisphere, a Closer Look

Similarly to Section 1, the current section attempts a closer look on the growth of mobile learning in the Southern Hemisphere, indicating the most important initiatives, policies and similar barriers that appear in the corresponding regions.
The section concludes by crosschecking the findings around the world and by providing recommendations and solutions which might help the spread of mobile learning.

Latin America

Proliferation and Penetration of Mobile Devices

The use of mobile phones is growing rapidly in Latin America. Mobile phone subscribers represent 106% of the population and surpass the rate of 120%

in several countries (GSMA, 2012). According to Vinicius Caetano, Senior Analyst for Pyramid Research, the mobile penetration will reach the 130% of the population by the end of 2015 (PS Newswire, 2012). Although the penetration of smartphones in Latin America is still low, it is increasing rapidly and is forecast to triple from 9% in 2010 to 33% in 2014 (GSMA, 2012).

The size of the population that does not have a fixed and mobile broadband connection is one of the most critical challenges for the countries of Latin America, as the percentages of unconnected population varies from 77% in areas like Venezuela to 98% in areas like Bolivia and Nicaragua (GSMA, 2011). However, by 2015, Latin America is expected to have almost a third of a billion Mobile Broadband connections (PR Newswire, 2012).

Review of Mobile Learning Initiatives

Several countries in Latin America have recently launched mobile learning initiatives and small-scale mobile learning programs. Most of the mobile learning programs in Latin America provide devices to either students, teachers or school supervisors adopting the OPD approach while only a few allow students to bring their own mobile devices (BYOD).

Lugo and Schurmann (2012) reported on some of these initiatives that involved only mobile phones and others that involve other mobile devices such as tablets and laptops.

Most of the mobile learning initiatives are OPD programs. Colombia implements a program against illiteracy called “Programa Nacional de Alfabetizacion” (National Literacy Programme). The aim of the program is to provide access to interactive educational content to illiterate people living in rural areas of the country. As part of the project, more than 250,000 mobile devices with appropriate SIM cards are going to be distributed at no cost to the target population.

Another OPD mobile learning initiative that aims to indirectly improve the educational process is the “Mobiles for Supervisors” in Argentina. This program aims to help school supervisors report and track data on students’ academic performance and schools’ needs in terms of both human resources and infrastructures. A number of 350 3G mobile phones with unlimited internet access were provided to school supervisors. The phones could also open Word, Excel, PowerPoint and PDF files. This allows supervisors to connect from schools in rural areas to the internet and to specific online system for reporting students’ performance and schools’ needs.

Two similar programs called “Puentes Educativos” (Educational Bridges) and “Raíces de Aprendizaje Móvil” (Roots of Mobile Learning) in corporation with BridgeIT implemented in Chile and Colombia respectively. The first one ran for three years (2010-2012) and expected to reach 660 teachers and about 22,000 students in rural schools throughout the country (Plaza and Carreras, 2010). The program aims to improve primary-school students' knowledge on mathematics, science and English language. This program is training teachers in smartphones use and using multimedia resources through the Nokia Education Delivery application. In particular teachers learn how to promote student-centered learning activities by incorporating mobile learning and digital resources into the curriculum. Afterwards teachers use the resources to develop and update curriculum plans for a variety of domains (Lugo and Schurmann, 2012). In addition, each participating school receives a smartphone along with a planning kit. Similarly, the program Roots of Mobile Learning will provide support to seventy-five school teachers in order to incorporate mobile technologies into their curriculum.

The "Seeds of Empowerment" was also an OPD project which was launched by Stanford University in the United States. Although it was originally implemented as a research project, "Seeds of Empowerment" reached schools in more than five Latin America countries (Argentina, Mexico, El Salvador, Bolivia, Brazil and Uruguay). The aim of this program was to increase access to basic education for children living in rural areas. According to this program, a specific mobile device called "TeacherMate" along with appropriate platforms was distributed to both students and schools in order to access specific educational content through the internet. However, over the last two years, a new interactive mobile application called "Stanford Mobile Inquiry-based Learning Environment (SMILE)" was developed which supported both iOS and Android. As a consequence, students and teachers could access educational content even from their smartphones. Therefore this project was shifted to an SCPD project since both devices were provided to education stakeholders and students and allows the use of students' smartphones for accessing the provided educational content.

Apart from the OPD projects, projects adopting the BYOD approach were also conducted in Latin America, for example, the PSU Movil in Chile. The Chile Ministry of Education had launched Educarchile, a national educational internet portal. The aim of this portal was to help low-income students improve their performance on PSU (Prueba de Sleccion Universitaria) exams. In order to make it easier for students to access the portal educational content, a mobile application called "PSU Movil" (PSU Mobile) was developed. This application was available for use by smartphones, providing educational content to students and incorporating exercises and online tests for practice.

Another BYOD initiative was implemented in Paraguay entitled “Evaluación de Aprendizajes a través de Celulares” (Learning Assessment through Mobile Phones) which focused on mathematics and Spanish language. According to this project students were able to perform tests through their mobile phones while their responses could be uploaded directly to the Paraguay’s Ministry of Education. The project was implemented in 300 public schools and more than 10,000 students have completed the assessment while the targeted population of Secondary Education Level is 18,000 students (Escolar, 2011).

Policies, Implications and Barriers to Mobile Learning

The high rates of illiteracy of people that live in urban and rural places of Latin American countries has motivated many governments to invest in mobile learning. However, in most cases the mobile learning initiatives operate as small scale projects. One exception is the “Programa Nacional de Alfabetization” in Colombia. Lugo and Schurmann (2012) in their research highlight that only in Colombia does the government actively support mobile learning. It was also the only country where representatives were aware of current mobile learning programs in their schools, although they were not aware of any program at the secondary level and above.

Most of Latin American countries do not have immediate plans to support mobile learning due to the fact that more than seventeen countries of Latin America have invested a lot of money into national 1:1 training programs, providing one laptop/netbook for every student. Consequently such efforts demand many resources for their implementation leaving limited resources for the evolution of mobile learning and policies in the near future. However, these programs indicate the commitment of the respective governments to integrate ICT into education and therefore a promising future for mobile learning.

Restrictive educational regulations raise another barrier for the integration of mobile learning in Latin America. Such regulations restrict the use of mobile phones in the classroom by the students and sometimes by the teachers banning mobile devices from the school environment. It is really encouraging that in the last years such restrictions have begun to loosen up. Another roadblock towards mobile learning is the low percentage of 3G or 4G network coverage. While for the developed countries the average coverage is about 90%, in Latin America coverage is less than 55%. However, as Katz indicates, the penetration of mobile broadband services in the area is going to be highly increased (Katz, 2011).

Africa and the Middle East

Proliferation and Penetration of Mobile Devices

There has been a rapid and widespread uptake of mobile phone devices across Africa and the Middle East (AME) over the last few years. Reports have shown that the number of mobile subscribers in Africa exceeded 620 million in September 2011, making it the second largest mobile phone market in the world after Asia (GSMA and Kearney, 2011). The number of mobile users has been increasing rapidly the past ten years, growing at an average rate of 30% per year, and is estimated to reach 735 million by the end of 2012. That is a surprising large number when taking into consideration that it is a continent of approximately 1 billion people that has suffered several difficulties in the last decades.

In the Middle East, mobile penetration rates were expected to reach 93.9% during 2011 and 125.5% in 2015 (Cherrayil, 2010), with Iran and Afghanistan driving the growth in this region. According to Gallup, 87% of Arabs aged between 15 and 29 years old had access to mobile phones in 2010, showing 79% increase since 2009. In wealthy countries, such as the United Arab Emirates and Qatar, the penetration rate can be more than 100%, while in poorer countries like Palestine and Yemen, that is expected to reach high levels due to growing youth market and new mobile network operators (Muttoo, 2011). All this growth in the mobile phone market, along with the price drop of devices and the low network usage cost, makes mobile learning an attractive field for future educational solutions.

Review of Mobile Learning Initiatives

The limited number of mobile learning projects in the AME region shows that the penetration of mobile technology in the educational field is still in the early stage.

The Government of Qatar is funding research initiatives through the Qatar Foundation to implement mobile learning to train the Qatari workforce. A recently funded research project (NPRP Grant # 4–125–5–016)[1] is investigating the use of mobile learning to improve the communication skills of employees so that they can function effectively on the job.

Shafika Isaacs outlines recent mobile learning projects and initiatives in the AME region (Isaacs, 2012). Nevertheless, the six EFA (Education for All) goals placed by UNESCO indicate that mobile access will be expanded to education

1. NPRP Grant # 4–125–5–016 from the Qatar National Research Fund(a member of Qatar Foundation).

and will improve the quality of learning. Some typical examples of mobile learning initiatives in AME which try to meet the EFA goals are reported below.

Pesinet was a SCPD project in Mali which intended to improve the health care of children by early detection of illnesses and better record keeping. Mobile devices are used to upload information to an online database where doctors review them and are alerted for any illnesses. Families pay a small monthly fee to enroll their children to the program and can benefit from medical examinations and half the cost of medication needed to treat a sick child. From early 2012 to October 2012, Judith de Benoist is mapping Pesinet's data to improve preventative action of the potential 2,000 beneficiaries of the program (Pesinet, 2012a) and the Pesinet organization is already growing and planning to expand to other SSA countries (Pesinet, 2012b).This project is in line with the first EFA goal which calls for the improvement of the early childhood care and education for the world's most vulnerable and disadvantaged children.

Jokko—an SCPD initiative launched in Senegal by the United Nations International Children's Emergency Fund (UNICEF) and Tostan (RapidSMS, nd.)—is SMS-based and learners use a free-based platform to communicate with a network of people by sending SMS to a single number. The project also introduces mobile phones as pedagogical tools to teach and reinforce literacy as well as the organization and management skills taught in Tostan's Community Empowerment Program. According to Beltramo and Levinethe, the project provides to its beneficiaries the opportunity to develop literacy and communication skills (Beltramo and Levine, 2010), enhancing the decision making among youth and adults. Jokko is in line with the third EFA goal which calls for lifelong learning where children and adults can satisfy their learning needs by having access to suitable learning and life-skills programs.

Project Alphabetisation de Base par Cellulaire (ABC) in Niger was a collaborative initiative which adopted the OPD approach between Catholic Relief Services/Niger, Tufts University and the University of Oxford (Project ABC, 2010). This project uses multimedia phones pre-loaded with a digital curriculum in the local languages of Hausa and Zarma. This curriculum was taught to adults by local trained facilitators and learners use basic SMS messages to study functional literacy and numeracy for a few hours per day. Preliminary results showed that the average math test results in villages that use ABC were higher than in villages that did not use it, even several months after the end of classes. This project is in line with the fourth EFA goal which calls for adult literacy improvement and access to basic and continuing education for adults.

M4Girls was a pilot project which also adopted the OPD approach and took place in South Africa. The project was intended to address learning performance differences in mathematics between boys and girls from underserved communities. Two schools were selected as pilot schools for the project by the North West Department of Education in South Africa. The project involved issuing 20 girl learners in the two schools with Nokia 6,300 mobile phones that contained curriculum-aligned Mathematics content—in the form of mobile games and videos—which was developed locally by Mindset Network (Mobileactive.org, 2011). Even though phones were used mainly to listen to music, access the Internet and communicate with others, female users felt more technologically confident (Mindset Network and Neil Butcher and Associates, 2009). This project is in line with the fifth EFA goal which calls for gender parity and equality and focuses on ensuring full and equal access to high quality basic education for girls.

Life Orientation and Life Skills (LOLS) was a BYOD project in South Africa that utilizes mobile phones to supply advice and subject support to learners and teachers of LOLS. The program intended for grades 8 and 9 as a sequel of other program for grades 1 to 7 in order to provide efficient education for HIV/AIDS prevention (IBE, 2003). Users of the program stated that they developed technological and digital skills while using the mobile phones and improved their life skills. This project is in line with the sixth EFA goal which calls for improving the quality of all aspects of education and ensuring that positive outcomes are achieved by all in literacy, numeracy, and essential life skills.

It is worth mentioning that according to Isaacs's report no specific project could be identified in the region which is in line with the second EFA goal which calls for universal primary education (Isaacs, 2012, p. 21). A theoretical case was made in Nigeria to offer primary education to nomadic children with the use of mobile phones (Aderinoye, et al., 2007). Similarly, efforts to provide open school led by the Commonwealth of Learning and its partners offer new ideas for incorporating mobile phones in primary and secondary education as well (Mishra, 2011).

Policies, Implications and Barriers to Mobile Learning

Forty-eight out of fifty-three countries in Africa had some form of ICT in their education policy and development in 2007 (Farrell and Isaacs, 2007). Nowadays, most of these countries have further advanced their strategies and policies on ICT. Rwanda developed an ICT in Education Policy and a draft Implementation Plan in 2009 (Isaacs, 2011), while South Africa reinforced its

White Paper on e-education that was adopted in 2004. Additionally, global guidelines on policies were established to ensure similar future development.

Shafika Isaacs highlights some recommendations for national policies which can help mobile learning to play a significant role in the educational field of every country in the region of AME (Isaacs, 2012). A value proposition for mobile learning must be built to attract attention and investment from government funding. This proposition should focus on four major attributes. The first is the fact that mobile phones provide easier access to education and information to children and adults who were previously unable to enjoy that. Secondly, how the use of mobile phones can improve the experience and quality of learning. Thirdly, how mobile phones improve the decision making skills of individuals. Finally, how the use of mobile phones can improve the administration, management and governance of local, national and regional education systems.

Another recommendation that arises is the need to encourage supportive policies in other government sectors. Studies have shown that national, regional and global policies on trade, telecommunications and ICT highly influence the penetration of mobile phones in the market (Adam, et al., 2011). Cooperation between education and finance departments is necessary so that cost effective mobile phone access is established at countries that have low average income. Furthermore, policies on internet governance, safety, security and intellectual property rights are highly important and directly related to the growth of mobile learning.

Additionally, policies on mobile learning need to take into consideration the effects of rapid advances in mobile technology and how these can influence and alter the educational landscape.

Finally, while in the policy development stage, groups and communities that were previously marginalized from the decision making process, need to be taken into consideration. Parents, guardians, media and youth are such examples that must have the opportunity to take part in the policies development and contribute to their improvement.

Although mobile penetration in the AME region is growing fast, the expansion of mobile learning initiatives is relatively weak due to various roadblocks. This is mainly due to the fact that government decision-makers are relatively unaware of the potential of mobile phones and the role they can play in improving the quality of education. This awareness is enhanced by the lack of effective initiatives and research projects that would provide evidence on the efficacy of mobile learning.

Another barrier is the lack of modern mobile phones in many poor areas.

Learners usually own or have access to mobile phones when they are older, missing the opportunity to benefit from them in younger age. Furthermore, absence of industry standards also serves as a drawback, when issues like screen size, resolution, support for programming languages, audio and video formats, internet browsers and memory sizes are not standardized.

Lastly, anti-mobile sentiments in AME form a significant barrier to mobile learning. Worries about the disruptive nature of mobile phones and safety around them expressed by teachers, parents and the media have in many cases led to complete banishment from school premises.

Asia and the Pacific

Proliferation and Penetration of Mobile Devices

Asia and the Pacific is a place of contradictions as regards the exploitation of mobile devices varying from the impressive percentages of Japan, China and New Zealand to the low percentages of Myanmar (New Media Trend Watch Asia-Pacific, 2012; So, 2011, pp. 9-11).

Asia and the Pacific holds 2.15 billion mobile phone users in the year of 2012 which is equivalent to 55% of the global sum. According to recent estimations "...by 2016, Asia Pacific will account for 57.7% of all mobile phone users—nearly ten times the North American share. China and India contribute most to this teeming mobile population, with 880 million and 470 million users, respectively, in 2012. In China alone, the mobile consumer base will top 1 billion in 2014" (eMarketer, 2012). If such estimations become true, the use of mobile infrastructures will become a primary platform not only for educators but also for advertisers, bankers, and marketers of Asia Pacific region. Not surprisingly citizens of the region are experiencing a smartphones revolution as most of the internet users are leapfrogging the era of PCs or of Tablets and they are moving forward to smartphones (New Media Trend Watch Asia-Pacific, 2012). As tracked by the GfK group in Asia, in countries such as Singapore, Malaysia, Thailand, Vietnam, Indonesia, Philippines, and Cambodia the demand for smartphones has been catapulted in the range of 40% to 400% more over the same period last year (GfK, 2012).

Review of Mobile Learning Initiatives

In such challenging environment a variety of mobile learning projects take place, despite the existing contradictions where citizens in Australia and New Zealand make an extensive use of mobile devices and smartphones to access internet repositories up to 40% or in Indonesia which has one of the most challenging smartphone penetration rates of 62% versus to the low rates of Nepal.

In areas where minor ICT and mobile infrastructure exist, most of the mobile learning initiatives are targeted to enhance the current level of education (so called literacy education). India, Nepal and Pakistan are typical examples, where gender disparity becomes an additional roadblock in adult education as females have significantly lower access to educational materials (So, 2011, p. 12). In Pakistan an OPD project was conducted, where 250 girls living in rural areas of the Punjab were provided with a mobile device in order to improve their English language skills by receiving daily SMS. The effort was supported by UNESCO, a local nongovernmental organization, and a local mobile provider Mobilink. Project's results were so promising that the initiative was evolved to a SCPD project (project of share cost) in order to include more than 1,250 girl participants from the Punjab.

Similar positive findings are also indicated by Matthew Kam during an OPD pilot study held in North India (Kam, et al., 2009). The study took the form of an after-school program, during the afternoons at a private village school affiliated with a nongovernmental organization in North India. The main goal was to investigate learning impacts that English as a Second Language (ESL) games on cellphones have on lower-income rural children. A number of cellphones preloaded with ESL learning games were to be loaned to the participants from late December 2007 to early April 2008.

On the other hand, in areas which have sufficient ICT and mobile infrastructures mobile learning projects are targeted to the provision of distance education and informal learning services. The Open University of Philippines conducted a BYOD project as part of a mega-project called the Pan Asia Networking Distance and Open Resource Access (PAN-DORA). As Rammos et al. describe in their study, the project called "Viability of Mobile SMS Technologies for Non-Formal Distance Learning in Asia" seeks to determine the utility of SMS technology as a basic tool in non-formal education. A similar effort was made by the Health Sciences University of Mongolia in cooperation with MDFI agency and the English for Special Purposes Foundation who developed learning material that could be delivered via SMS (Ramos, et al., 2006). Furthermore, a typical example of successful large scale project was the Text2Teach initiative which was a combination of BYOD and of SCPD models—as it was also sponsored by Nokia. The project enables students to access and download—or even request via SMS-multimedia educational material in sciences and mathematics. According to the Ayala Foundation the project has expanded to include 550 schools and thousands of students in the Philippines (Ayala Foundation, 2011).

Japan, Bangladesh and South Korea have also launched large scale mobile learning projects—at a national scale in some cases—as their national policy facilitates the use of mobile devices in education. In the areas of Japan and Bangladesh, Eijiro and English in Actions respectively, are two BYOD projects aiming to improve citizens' English language skills in each area. Both projects are successful with very good results so far (So, 2011, p. 16). Furthermore, in South Korea the SK Telecom has partnered with the largest U.S. education company, Houghton Mifflin Harcourt (HMH) to provide mobile content to enhance the English proficiency and academic outcomes of students throughout Korea (Houghton Mifflin Harcourt, 2012). Due to the program's success SK Telecom and HMH announced that they will also offer smart learning in other countries with high demand for education, including China and India (TelecomTiger, 2012).

Finally countries in areas which have strong ICT infrastructure and mature mobile market with high penetration of mobile phones mobile learning projects intend to promote future learning environments. The Australian and New Zealand Mobile Learning Group (anzMLearn) outline the most important initiatives in the region for the last two years. Charles Stuart University has established the mLearn—a large scale BYOD project—that is working on a range of initiatives that focus on the learning aspects of mobile technology for the period of 2012 to 2013. The mStories is a participatory project that was aimed to explore mobile technology creatively launched in Sydney in October 2011 exploring how we can tell stories with text, image, sound, video and anything else available on the mobile device. The University of Technology in Sydney in 2011, lunched the "Student-Generated Pod and Vodcasts to Improve IT Career Understandings" project which focuses on understanding the learning processes that first-year university students engage in when undertaking a team student-generated mLearning project (anzMLearn, 2012,).

Other innovative mobile learning initiatives include projects like the Smart School governmental project in Malaysia, the FutureSchools@Singapore project in Singapore also held by the government and the Promotion Strategy for Smart Education in South Korea are exploring the integration of mobile devices into everyday school environment (APIIT, 2012; IDA Singapore, 2012; OECD, 2011), preparing the students for the learning environments of the future.

Policies, Implications and Barriers to Mobile Learning

In the challenging Asia–Pacific region, policies related to mobile learning are in line with the controversial spread and use of mobile devices in different areas. In areas where mobile penetration rate is high, such as Australia, China, New Zealand, Japan, South Korea, Singapore, Thailand, Malaysia, etc., mobile learning is strongly supported by the governments who promote new Educational Laws and ICT policies (SAMEO, 2012; So, 2011, p. 19).

In areas where ICT infrastructures are under development, such as India, Nepal, Pakistan, etc., although there are no governmental policies specific for the development of mobile learning, some references are included in the general educational policy plans about ICT.

Not surprisingly in the Asia–Pacific region it is generally accepted that governments and universities play a critical role in encouraging mobile learning and in cases where additional stakeholders are involved such as NGOs, Mobile network providers, ICT companies, etc., success and sustainability of mobile learning initiatives are granted. Such successful projects or case studies contribute to overcome the resistance to mobile learning adoption, commonly observed in primary and high schools environment by the school administrators, teachers' boards, and parents.

Some of the most commonly observed barriers in the region concern the risks of students being exposed to inappropriate content, to inappropriate behaviors such as cyber-bullying, gaming addiction, and the perception that mobile devices will probably distract rather than will facilitate the educational process. Apart from the concerns about students' misuse of mobile phones additional barriers are related to potential health implications of students using mobile devices such as asthenopia, or excessive eye strain (Bedinghaus, 2011; Knowlton, 2011), radiation absorption, thermal and non-thermal effects, cancer, etc. (Wikipedia, 2012; Cohen, 2012; WHO, 2011) affecting both their psychological and physical development.

The cost and availability of mobile devices is another important barrier towards the adoption of mobile learning. For that reason universities tend to follow the BYOD projects approach. On the other hand, as it is rare for young students to possess their own mobile devices, in primary or in secondary educational level schools the approach of OPD or of SCPD is followed. Another key barrier, mainly in the Asia region, concerns the lack of teacher training and support or the lack of high quality educational material. As a result, most the teachers are reluctant to adopt this new emerging teaching/learning method.

Intense educational programs either in primary or in secondary schools pose an additional restriction to the adoption of mobile learning as students and teachers feel the pressure to meet the program's standards having no time to experiment with other educational scenarios.

As elsewhere in the world, a set of clear guidelines and policies (at a governmental level) on the use of mobile phones in the school/university environment is fundamental to overcome the above mentioned barriers.

Cross Comparison Conclusions

Reviewing the status of mobile learning around the globe, some critical issues can be highlighted. The current section aims to point out similar problems, hesitations and mindsets across the seven reviewed regions of Canada, the USA, Europe, Russia and Ukraine, Latin America, Africa and the Middle East, Asia and the Pacific. Emphasis is given not on the benefits but on the common roadblocks towards mobile leaning in an effort to identify the cause of the problems which slow down the adoption of mobile learning. As a deeper understanding of the causes may contribute to the solution of a problem, some useful recommendations are also reported.

Rapid proliferation of mobile devices (including the smartphones) is a commonly observed phenomenon. From the isolated rural areas of Nepal and Mongolia to the most crowded ones of China and New York, the number of mobile subscriptions is growing impetuously. Recent studies estimate that "...the worldwide mobile subscriber base is expected to reach 6.5 billion by the end of 2012, taking global mobile penetration to approximately 91 percent" (Portio Research, 2012). Access to a mobile device is significantly superior compared to access to a laptop or a PC (personal computer) due to the low cost of mobile phones. Although a new challenging environment for mobile learning immerse worldwide, supported also by the expansion of 3G or 4G technologies (comScore, 2012), the adoption rate of mobile learning does not evolve at equally frenzied rates. The main reasons for such delay can be grouped in five categories which are described below in descending order of importance.

Insufficient (Educational) Policies

Availability of mobile learning initiatives around the world, despite their differences in scope, complexity and implementation cost, is a significant indicator that mobile learning is gradually getting the attention of governments, districts, (educational) institutions, industry and other stakeholders.

Though, one of the most critical obstacles towards the wide adoption of mobile learning can be considered the lack of (educational) policies, at a national level, which outlines the framework of the appropriate use of mobile devices as part of the everyday education process.

In regions where a national education policy advances the use of mobile devices, such as South Korea, Colombia, Malaysia, Japan, Manitoba, Alberta, the District of Columbia, Australia, and partly the UK and Rwanda, potential hesitations towards the adoption of this educational model have been significantly restricted. On the contrary, in regions where no specific guidelines regarding the use of mobile devices are described as part of their educational policies, facilitation or the prohibition of mobile learning is equally possible to occur. It is very often the case where school principals or institutions or even broader (educational) boards, based on the blurriness of the (educational) landscape, are adopting the worst case scenarios prohibiting and even banning mobile devices from the school or the work environment.

Hesitating Mindsets (Health and Psychological Issues)

In all of the seven regions examined, the positive implications of mobile learning have been widely acknowledged. In Asia and Canada specific case studies took place in order to examine potential positive effects for disable students and autistic children to learn communicate and interact with others using mobile devices (Ally and Palalas, in press; So, 2011). Though, accessibility issues also arise for many mobile devices as they cannot be used by people of different ages and/or of different disabilities.

Lack of educational policies which specifically address issues of mobile learning causes another side effect which also seems to be a significant roadblock for the adoption of mobile learning. In almost all of the examined regions some school boards, school principals, teachers, and parents report hesitations about the misuse of mobile phones in the class. The most commonly reported hesitations, in all seven regions, concern students' distraction in the class, security issues, exposure of students to risk environments containing inappropriate material, hostile behaviors such as cyber bullying, sexual offences or sexting, potential cheating during school examination and gaming addiction. Negative effects on students' health and on their physical development, reinforces further the ambiguity to the key role players (i.e., in Asia region) regarding the appropriateness of using mobile devices in schools. The most commonly reported negative implications concern, thermal and non-thermal effects, radiation absorption causing cancer, asthenopia, excessive eye strain as a result of excessive use of mobiles, etc. (Bedinghaus, 2011; Knowlton, 2011; Wikipedia, 2012; Cohen, 2012; WHO, 2011).

Until clear scientific evidence emerges proving the appropriateness of the use of mobile devices—especially by young students—without any potential negative implications to their health and specialized educational policies are formed, such critical concerns will continue to lead many districts and other key role players to exclude mobile devices from the school environment (i.e., in Latin America, partly in the USA, in Africa and in Europe).

Socioeconomic and Technology Limitations

High startup costs of mobile initiatives, especially of OPD programs is an additional barrier. Even in SCPD projects, the communication cost and the cost of mobile devices are limiting the adoption of mobile learning.

Equity issues among students' ability to access modern mobile phones such as smartphones due to low income or due to social-demographic origins, may also be an issue during a BYOD project. Such dilemmas arise not only in the poor areas of central Africa, or of Afghanistan, Bhutan and Nepal but are also present in more wealthy regions such as New Zealand and the USA.

On the other hand, a technological-driven limitation can be considered in the low population coverage by 3G or 4G networks (Latin America, Russia, Ukraine). Furthermore, the availability of a large number of standards and operating systems, programming languages, audio and video formats, screen sizes and resolution (Russia, Africa, Canada, and the USA) also serves as a drawback towards mobile learning.

Lack of Human Resources (Skilled Personnel)

As mobile learning is in its infancy, specific educational plans or guidance both for teachers and students on how to use their personal devices for educational purposes are rare. Lack of teacher training and support, or even of high-quality educational content as reported in Canada, the USA, Russia and Asia, in addition to difficulties incorporating existing learning content to mobile initiatives, reinforces teachers' resistance to adopting mobile devices in schools. Similarly, in the region of Russia a low level of technical training regarding the development and the evaluation of mobile content is commonly reported as an additional barrier to mobile initiatives. As a result of the above mentioned deficiencies, many teachers (and trainees) are reluctant to adopt this new emerging teaching and learning method.

Hardware Limitations

Finally, device related limitations including battery life, user interface usability, device memory, hardware and/or ergonomic limitations—such as screen size, small keyboards for typing and security issues, are also listed among the most commonly reported barriers to mobile learning. Though such barriers are the least important as technology rapidly excels and new gadgets and more handy and advanced mobile devices emerge every year proving that mobile devices and smartphones are spreading faster than any technology in human history (Degusta, 2012).

It is obvious that some of the above-mentioned limitations/barriers will be easily overcome (i.e., the Hardware Limitations) as mobile devices rapidly evolve through time, while for others (i.e., the Hesitating Mindsets) a social shift will be required. One way or another, mobile learning has been already "landed" in the educational landscape and it is expected to alter dramatically the way people, students and teachers learn, react, communicate and interact with the educational material and each other. A whole new set of pedagogical theories, of instructional design guidelines and teaching and learning practices will emerge in the near future, pointing to more skilled and effective tutors and students who will use Augmented Reality in the same way that overhead projectors are currently used in the classrooms.

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2

Mobile Learning in International Development

John Traxler

Abstract

Learning with mobiles now has a significant potential and an increasing visibility in the context of international development. There is a history of small-scale interventions stretching back to the turn of the century but the recent shift and growth away from a European and African understanding towards an increasingly North American perspective mean we may soon see significant progress. This chapter is a review of mobile learning in international development. It looks at the changing nature and expectations but starts by briefly exploring what the various terms might mean in this context before unpacking the issues behind the apparently simple ideas of using mobiles to deliver learning in international development.

Introduction

An account of mobile learning in international development is problematic; it seems to lie neatly and merely at the intersection of two concepts, namely mobile learning and international development, but sadly, these two concepts are fluid and very inconsistently understood so an account that starts from the top-down, from the concepts down to the examples is not easy. The opposite process is no easier. We might think that we could point to examples, that is, programs, projects and pilots that intuitively defined the idea of mobile learning in international development and work from the bottom, up towards an understanding of the concepts. We would however find that the nature, significance and distribution of such examples had been so filtered, skewed and distorted that any theoretical or abstract understanding was deeply problematic, flawed and untrustworthy. Furthermore, the mobile learning community has probably been both self-defined and self-referential. This mean that a search of literature for reports of mobile learning will throw up reports that chose to define themselves in that way and these reports will cite other reports that made the same choices. This will miss very many activities where mobiles have been used, such as open and distance learning (ODL), but not foregrounded in the same way, or where learning has been secondary, such as health programs, employment programs and community programs. The funding, evaluation and dissemination of mobile learning has skewed our knowledge of what has been achieved and what could have been achieved (Traxler, 2013a; Traxler and Kukulska-Hulme, 2005) and often such factors understate personality, local context, failure and multi-causality.

A pre-occupation with definitions may seem like a merely *academic* concern, in the worst possible sense. Talking about mobile learning, or worse talking about *m-learning*, has two further effects: it creates a sense of community but perhaps an exclusive one, and it creates a sense of continuity that is misleading as we attempt to extrapolate earlier trends and analyses (Traxler, 2012); it is perhaps an example of how unhelpful and misleading reification can be.

Whatever our reservations about terminology are, mobile learning has often been characterized by its fourfold capacity to extend education, to enrich education, to challenge educational theory and to engage learners. A critical examination of these four characteristics is another way to reach a much clearer definition of mobile learning and its significance to international development. Other chapters will devote space to the pedagogies and the technologies of learning with mobiles; the ones found in international development contexts are not unique or even unusual. They are more likely driven by social needs than by research questions and are perhaps more likely constrained by infrastructure. This chapter will only briefly reprise them and instead will challenge readers to imagine them in the various cultural and organizational contexts we describe.

What Is Mobile Learning?

This is clearly not the place to re-enact debates and definitions addressed elsewhere in this book, and addressed in earlier years (Traxler, 2007; 2008a). As readers are probably already aware of the general shape of these definitions and debates, we need only make a handful of extra remarks about the specifics of international development.

Enriching Learning

The mobile learning research community has demonstrated across a wide variety of settings that it can enhance, extend and enrich the concept and activity of learning itself, beyond earlier conceptions of learning. This includes:

- Contingent learning and teaching, where learners and teacher can react and respond to their environment and their changing experiences.
- Situated learning, where learning takes place in surroundings that make learning relevant and meaningful.
- Authentic learning, where learning tasks are related to immediate meaningful learning goals.
- Context-aware learning, where learning is informed by the history, surroundings and environment of the learner(s).
- Augmented reality mobile learning, where learning builds on local context supplemented by an audio or video overlay.
- Personalised learning, where learning is customised for the preferences and abilities of individual learners or groups of learners.
- Learning support and pastoral support.
- Game-based learning.
- Assessment techniques aligned to these new affordances. (Traxler, 2013b)

These all represent a trend that takes learning away from the classroom and the school, and perhaps away from the teacher, in fact away from the institution. At a practical level, they represent support for courses and programs that engage with the world outside the institutions, either exploring that world or training students to take their places in it. Many of the best examples of these achievements are resource-intensive and characteristic of the developed world. Their relevance to international development is indirect. Perhaps ideas will *trickle-down* as costs and coverage improve; perhaps the ideas can be implemented with simpler cheaper technologies; perhaps the ideas are too culturally specific to travel or transfer.

In the context of international development, they do however also represent a specific set of pedagogic assumptions about the complex relations between the institutions of education, people's lived experience and the nature and purpose of learning—these are not necessarily universal. Not all cultures would share the same assumptions. As we move from the informal learning within communities and families through primary education to technical and tertiary education we do see however greater global uniformity and more shared concepts.

Language and literacy are amongst the defining characteristics of local cultures and communities. There is sometimes an uneasy balance between global power languages (usually English, sometimes French), recognized national languages (that is, the language of government and the state education system), maybe a lingua franca, and also mother tongues and tribal languages. Mobile systems delivering literacy programs can unsettle these balances, delivering one language at the expense of others and favoring one community at the expense of others. The education system, and literacy, are not necessarily benign and national education systems have been used at times to bring marginal and nomadic communities, maybe the Cornish, the Roma, the Masaai and the San, into the national cultural mainstream.

We can say with certainty that not all cultures share these same assumptions because research has explored the underlying characteristics that differentiate cultures. There are norms, ones that uniquely characterize that culture. That places culture on a range of axes defined by:

- risk-taking vs. risk-avoidance;
- individualism vs. collectivism;
- hierarchy vs. equality;
- the extent of gender inequality;
- control vs. consensus, following Hofstede (2001); and also
- innovativeness vs. conservatism, according to Rogers (2003), though probably not independent of the risk axis.

Culture is uniquely characterized also by a specific balance between the formal, the established and the institutional on one hand and the informal, the indigenous, the local, the vernacular on the other hand, and perhaps the counter-cultural, the subversive and the disruptive too, amongst peer groups, communities, families, kinship groups and elders. Growing out of these defining characteristics of culture are equally important features that define a culture's ideas about pedagogy. There are questions, in a specific culture, such as, "What is worth learning?" "How is it to be learnt?" "Who can teach it?" "How can competence be expressed?" and so on, that implicitly define that culture's conception of learning, and thus of knowing.

All these factors make us question the extent to which the mobile learning of Western Europe or North America can be exported or globalized to cultures so different and so distant. Common mobile learning strategies, such as individual or competitive games, experiential learning, group-work and student-centered learning, may not translate into every culture because of dissonance with its conception of learning.

Extending Learning

The mobile learning research community has also demonstrated that it can take learning to individuals, communities and countries that were previously too remote or sparse, economically, socially or geographically, for other external educational initiatives to reach. This second category has included projects addressing:

- geographical or spatial distance and separation;
- sparsity, connecting thinly spread and perhaps nomadic learners to create viable communities;
- infrastructural or technical barriers;
- social, cultural and economic exclusion;
- physiological or cognitive differences;
- privacy and security;
- dead-time;
- corporate training and performance support. (Traxler, 2013a)

For the activities in this category especially those where learning is being extended into communities that are somehow culturally remote from the mainstream, we have to recognize that technology always has some ideology and pedagogy embedded in it. This includes mobile technologies. These technologies project the pedagogies, strictly speaking perhaps the epistemologies, of *outsiders* into communities that of course already have their own learning. There is a risk that mobile technologies delivering learning in this way represent either a Trojan horse or a cargo cult (Lindstrom, 1993; Worsley, 1957) that threatens or undermines a fragile educational ecosystem. The issue is not one of emerging markets or developing regions *per se* but of fragile cultures (or sub-cultures or even counter cultures) and their capacity to negotiate an optimal balance between the preservation of language, heritage and culture on the one hand and engagement with the wider world and the global knowledge economy, on the other.

What Is International Development?

In some ways, *international development* is an intuitively easy concept to grasp; it means attempting to make the people's lives better, when the people in question live in specific regions of the world, those regions most unlike Western Europe, North America and the Asia Pacific.

There are questions about the problems that *international development* is purportedly addressing and we need to expose these: Is it sparsity, rurality and distance? Is it poverty and deprivation? Is it infrastructure, capacity and organization? Is it the mixture of European colonial legacies? Is it national, cultural and linguistic diversity? Is it access to global markets, and participation in the global economy? These questions are as significant and powerful as questions about the language used in *international development*, the language of *leap-frogging* and *catching-up*, and seem to be largely questions about deficiency and deficit.

International development, and thus the *developed* and the *undeveloped* is (merely) one aspect of disadvantage (alongside other global *digital divides* such as income, ethnicity, gender, caste, class, regionality, age, social exclusion, disengagement, dropouts). Looking at *international development* in this way creates a wider context for discussing development and disadvantage. It creates a discussion about different aspects of disadvantage, perhaps the *digital divide* concept too (Traxler, 2008b). This approach defines *development* as a special but not unique case of disadvantage, disenfranchisement and educational exclusion, and opens up the possibility of a wider ranging account of mobiles attacking distance and disadvantage. The second alternative was to address mobile learning in *international development* in its own chapter.

The Past—an Example

At this point, it makes sense to inject a concrete example into the otherwise abstract narrative; now sufficient caution has been invoked and expectations correspondingly lowered. Choice and selection are however difficult; abstraction and generalization are however impossible. Owing to the author's own involvement, experience and commitment, the example of SMS Education Management Application (SEMA), largely undocumented, often springs to mind in seeking to reason about the possibilities of mobile learning in *international development*. The SEMA project sat at the intersection of innovation and scale, apparently simple technologies laden with ideologies, embedded in complex organization environments, and it has evaded agencies and donors rounding up the *usual suspects,* looking for simple truths. (The *usual suspects* and accounts of their successful projects can be found in the increasing number of reports and reviews coming out of agency and donor organizations—see later. This is not to say that the *usual suspects* do not do good work, unimpeachable work, improving the lives of thousands. The flaw lies in thinking we understand enough to explain, replicate, generalize and scale what they do.)

It is possible to provide a simple, linear and orderly narrative of the SEMA project. The name stood for *SMS Education Management Application,* and aptly and co-incidentally was also the Swahili word "sema" that means, "to say... to speak". Department for International Development (DFID) priorities, especially those of the *Imfundo* initiative within DFID London, were in-service training & EMIS, educational management information systems, because these represented the optimal places to intervene. DFID on behalf of the Ministry of Education, Science and Technology (MoEST) of Kenya accepted a project proposal based indirectly on a scoping study that explored teachers' and officials' access and attitudes to a range of ICTs. The proposal was based on some limited international experience of educational messaging, mainly in the UK and South Africa, and some technologies and suppliers that could support it. The driver was the implementation of Universal Primary Education (UPE) in Kenya. It had led to large class sizes and teachers with little initial training struggled in a system which employs too much central control and too much frontal teaching. Other problems, specifically girl-child marriage, and corruption and inefficiency in allocating salaries, textbooks and food for orphans, were consequences of the wider problems. The SEMA project would support the School Empowerment Program (SEP), a middle leadership capacity building program of in-service staff development for primary teachers nationally, part of school-based teacher development (SBTD) that used a correspondence-course, distance-learning format and built the idea of "leading from the middle". SEP was supported by BBC, Manchester University and the University of Wolverhampton, building capacity in the Kenyan Institute of Education (KIE), the Kenya Broadcasting Corporation (KBC) and other local bodies. It targeted specific cadres of 200,000 teachers. The software and messaging technology were procured by competitive tender from local companies. Stakeholders are comprised of MoEST officials, leading SEP teachers, technologists from Cellulant, the winning company that had privileged access to Safaricom servers, and some external consultants convened at monthly intervals to review progress and modify the specification. The outputs and activities were technology procurement, development and deployment of (i) SMS study guide (supporting printed, broadcast, video, face-to-face interactions and materials); (ii) a small virtual learning environment (VLE), mediated entirely by SMS; (iii) EMIS gathering national school statistics monthly followed by two large-scale phases of pilots. This apparently orderly account belies the difficulties and misunderstandings in developing a large administrative, technical and pedagogic system without sufficient recognition of the wider environment. The deployment of the system stalled and many of the subsequent informal recommendations by the author to DFID, paraphrased below, indicate the problems but have a more general significance. They indicate the mismatch between technical development of a system and users' understanding and acceptance of it. These recommendations include:

- clear and authoritative policy in place that describes the aim and purpose of the system;
- an acceptable use statement that clearly articulates how this policy is operationalized especially in terms of messages that clearly exemplify the policy and perhaps the anticipated volume, rate and balance of messages users might expect;
- working practices that publicise and police the acceptable use statement;
- technology to support this policing, giving officials the necessary information with performance that will not degrade in the event of any national rollout and supported by power supplies with defined levels of "up-time";
- induction and cascade training and documentation revised and monitored to ensure users, especially those at the "bottom" of the cascade process, are aware of the form and content of acceptable messages and usage;
- an informal and "lightweight" evaluation specifically to explore users' attitudes to the systems and their benefits from the system and consequently of its cost-effectiveness specifically in the context of the policy articulating the system's aim and purpose;
- an examination of the system's projected costs, benefits, savings, effectiveness and sustainability specifically in the context of the policy articulating the system's aim and purpose;
- training, syntax and monitoring revised in the light of users' errors and behaviour evidenced in the system traffic.

Working from the *top-down* and aiming at scale can seem slow, inefficient and frustrating compared to working in agile, immediate, community-based projects from the *bottom-up*, and these recommendations hint at some of the barriers in achieving progress across a large dispersed organization with little capacity or experience of systemic technical innovation and change management. In one sense, the original boundary and original briefs were drawn too tight; this constrained the design and development and then the training and evaluation. In a different sense, the ideas of participative design were very alien to the official culture of the Kenya school system and its officials.

In those days in Kenya, the data gathering of evaluation depended on questionnaires distributed by couriers on motorcycles and the data analysis depended on clerks manually tallying up the ticks on those questionnaires.

Anything more innovative or sophisticated would not be accepted by the Ministry M & E (monitoring and evaluation) team. Earlier informal evaluation efforts had been rendered fairly futile as Ministry protocols involved taking very high-profile United Nations Development Program (UNDP)Range Rovers with high-ranking officials into remote village schools and asking for teachers' views on the project—not a situation likely to lead to very authentic responses.

Evaluation of Learning with Mobiles in International Development

This leads us neatly to a review of evaluation. Learning with mobiles, and most other activities with mobiles, are difficult to measure and monitor. Until recently, it was technically too challenging, cumbersome or contrived to capture interactions and activities on the fly, in the moment, and we resorted to the paradox of making learners stationary so that they could report on their mobile learning. The technology to unobtrusively and accurately monitor and measure learners on the move is now improving so this is not the challenge it used to be but it is still unlike the evaluation of formal education and of learning with computers. With both of these, it is an obvious characteristic that learners stay still, stay in one place and focus on the substantial task in hand. Learning with mobiles is however at its best, at its most quintessential, lightweight, spontaneous, opportunistic, informal and woven into everyday life and again separating the various causes and effects is a challenge, especially for researchers with a particularly empirical or experimental way of looking at life. This is the theme of multi-causality appearing again.

A further challenge is evaluation in *international development,* in different and distant communities. These may be communities in cyberspace and *phonespace*, communities of educationally disengaged and disenfranchised in rustbelt Western Europe or geographically distant communities in rural Africa. It is challenging because the further and stranger we get from our Western European metropolitan, institutional and professional environment, the less chance there is for a shared language, shared confidence and shared trust informing any conversation about educational progress and educational outcomes, or even the nature of education itself.

Agency Interest

It is however doubly important to explore the place of mobiles to support and deliver learning in *international development* now because there has been a big increase in interest amongst the agencies, corporates and ministries, and a shift in interest outside Western Europe. This introduces new dimensions. Back in October 2010, the *UNESCO chair in e-learning* in Barcelona held an international seminar that focused on *mobiles, learning and development* whilst about the same time, the Development Fund of the GSMA, now subsumed into the GSMA Mobiles for Development program, the trade association for the MNOs (mobile network operators), published *mLearning: A Platform for Educational Opportunities at the Base of the Pyramid* (GSMA, 2010). This was intended to give MNOs a sense of the business opportunity. In February 2011, the massive *World Mobile Congress* in Barcelona sponsored the first of its first annual awards for learning and attracted an impressive field from organizations working in *development*. In August 2011, United States AID (USAID) convened the first *m4Ed4Dev* symposium in Washington DC and later launched the *mEducation Alliance* in early 2012. In November 2011, the WISE debate in Qatar focused on *mobiles, education and the hard-to-reach*. In December 2011, UNESCO in Paris convened its *First Mobile Learning Week*, consisting of both closed sessions of experts and open sessions for the community. These sessions focused, regionally and globally, on policy issues and teacher development, the latter seen as a crucial place to break into the educational cycle and promote *education for all* (EFA). In March of 2012 there was a further *International Symposium* in Washington organized by Consortium for School Networks (CoSN), which drew together major practitioners and stakeholders. The *mEducation Alliance Symposium*, in September 2012, entitled *Partnering For Scale And Impact,* illustrated the growing emphasis and direction of corporate and agency priorities. The second UNESCO event, another *Symposium,* included in its *Mobile Learning Week,* in Paris in February of 2013, continued to align with wider objectives within the development community, shared with USAID, and focused on three particular EFA goals as they relate to mobile learning, namely:

- Improving levels of adult and youth literacy: how mobile technologies can support literacy development and increase reading opportunities (not writing opportunities, author's comment).
- Improving the quality of education: how mobile technologies can support teachers and their professional development.
- Achieving gender parity and equality in education: how mobile technologies can support equal access to and achievement in basic education of good quality for all, in particular for women and girls.

Significantly, the *Symposium* sought contributions on Mobiles for Literacy, Mobiles for Quality of Education and Mobiles for Gender Equality so concerns about language and literacy and the onslaught of mobile learning are at least plausible, especially as the nature of UNESCO itself means it communicates with national governments not marginal communities. The UNESCO initiative, supported by Nokia, now has several components, namely, Policy Research and Advocacy, Teacher Support and Development and Mobile Learning Technology Concept Development and has started to convene panels and publish on all these three components. The focus on teacher development and policy development tip the emphasis towards the formal institutions of education and away from informal, lifelong and community learning. It is in the nature of international agencies like UNESCO to talk to governments rather those citizens who dissent, disagree or differ from those governments. The same is true for many corporations and foundations: national governments are gatekeepers assenting—or not—to any large-scale programs on their territory.

In this period, there have been significant reports to the World Bank, *eTransform Africa Final Report*, and to the World Economic Forum, *Accelerating the Adoption of mLearning: A Call for Collective and Collaborative Action*, another one from GSMA, their *Transforming learning through mEducation* produced by McKinsey & Company, in Mumbai, and the *eLearning Africa 2012 Report*. Another trend has been agencies trying to understand the issues of mobiles and learning by commissioning specific regional surveys: GSMA recently undertook user surveys in Ghana, India, Morocco and Uganda whilst UNESCO has chosen Mexico, Pakistan, Nigeria and Senegal. Nokia also sponsored, with UNESCO, a crowd-sourcing challenge, promoting mobile technical innovation to bring about different aspects of education for all and social justice. UNESCO is likely to take their policy guidelines out to a similar handful of countries.

Increasingly the conception of learning with mobiles will be influenced by these organizations and agencies, by their conceptions and their priorities. UNESCO, for example, says, "Mobile learning, or 'm-learning', offers modern ways to support learning process through mobile devices, such as handheld and tablet computers, MP3 players, smartphones and mobile phones", whilst the USAID position is "the identification and applications of mobile technologies that can be effectively leveraged to address pressing educational issues including: literacy, appropriate educational content development and dissemination, system strengthening (such as education data for decision making), accessibility for learners with disabilities, professional development for educators, and workforce development". These definitions are somewhat at odds with the current ideas of the mobile learning research communities, mentioned later, that have moved away from such techno-centric definitions towards conceptions of mobile learning that focus on the mobility of the learner, on the capacity of learners to cross contexts, and on conceptions of learning aligned to mobile societies (Traxler, 2008a).

Furthermore, in the agencies' policy and publications, there is an unresolved tension. This is the tension between the conception of mobiles as the instruments of reform and improvement, as technologies for ministries, educators, schools and colleges to enhance the management, content and delivery of their (existing) curriculum, and, on the other hand, the conception of mobiles as the instruments of dramatic social, economic and political change, that sweeps away those same ministries, institutions and officials of education rather than reforming and improving them, the *Arab Spring* depiction.

To put it another way, in many parts of the world the (formal) education system is *broken,* part of a wider *crisis*, no longer aligned to or adequate for the different societies and cultures that we now inhabit, societies and cultures that beset by political, economic and ecological dislocation. Mobiles are universal, nearly, ubiquitous and pervasive. This changes our relationships to learning, knowing and understanding; to community, relationships and identity; to ethics, norms and expectations; to employment, economies and economics; and to creativity and expression is part of that wider crisis (Traxler, 2010a). This position contrasts with the notion that learning with mobiles is essentially just the latest opportunity for institutional e-learning and can thus be co-opted into existing educational systems.

These arguments are characteristic of a technology that inhabits the *bottom-of-the-pyramid* and inhabits the *international development* context in ways that would never be true of other ICTs such as TVs and PCs and account for a tension that could never be present in any discussion of PC-based e-learning in *international development*.

American and Corporate Interest

Meanwhile, the past two or three years have seen much greater interest and activity in learning with mobiles in North America, especially in the USA, and this is gradually shifting the intellectual and commercial center of gravity away from its roots in Western Europe, particularly the UK and parts of Western Europe, in Asia Pacific, and in South Africa. It is also changing the nature of what is understood to be the most effective pedagogies for mobiles. Historically, the Western European interest (Kukulska-Hulme, et al., 2011) has been on informal and contextual learning underpinned by a substantial engagement with theory, for example Actor Network Theory (Bell, 2010), Conversational Theory (Laurillard, 2002; 2007), Activity Theory (Uden, 2007; Wali et al., 2008) or socio-technical systems ideas generally, inherited from the earlier theorising of e-learning. These have been encapsulated in the *mLearn*, IADIS and WMUTE conference series, the *International Association for Mobile Learning* and the *International Journal of Mobile and Blended Learning*. *mLearn* started in 2002, the others shortly after. The South African contribution has often been innovative improvements in *service delivery* alongside a Western European intellectual tradition. Now, corporate training, the connected classroom, edutainment and drill-and-test packages are an increasing part of the total picture, representing changes in the overall composition of mobile learning, changes predicted and accelerated by successive recent Horizon Reports (Johnson et al., 2011). These are also illustrated by the contributions to the annual *mLearnCon* conference, started in 2010, and by the growth of *SIGML: Mobile Learning Special Interest Group*, started about the same time within *ISTE* (the US International Society for Technology in Education). As well as their educational significance, they point to growing confidence in viable business models for at least some aspects of learning with mobiles (Dede, 2011).

One particular spin, echoing earlier discussion in the UK and in Africa but not reflected in the research literature, is the notion of *bring-your-own-device* as a strategy combining choice with sustainability, though not without problems in terms of infrastructure, equity and quality (UNESCO, 2011; CoSN, 2011; Traxler, 2010b). This strategy represents however a significant shift in the locus of authority and control within the classroom and does not always align comfortably with traditional pedagogies in Africa and Asia.

Another consequence of the growing US involvement in learning with mobiles and the rise of the *apps economy* is that learning with mobiles now seems to no longer need research or researchers to work with the practitioners and policy makers. *"Education?—there's an app for it"*, people now say, and everyone understands it; culture and pedagogy no longer seem to be components or obstacles. In the practitioner and policy communities of the developed world, everyone owns a powerful mobile device and understands its affordances, for learning and anything else. These are clearly now just common *sense*, no longer requiring specialist research input or practitioner experience. Everyone, including those outside the organizations of formal education, has a theory of education and has a theory of learning with mobiles, perhaps several, perhaps not ones that are proven, profound or rational, perhaps only something simplistic like *content is king*. This means that the role and impact of the research community is becoming marginal. This is important because as we use mobiles for learning in *international development*, we will encounter and probably ignore local theories of learning, theories embedded in their traditions and their culture and expressing their ideas about what to learn, where, when, why and how to learn, who learn from. The more diverse and critical our global ecology of learning and its theories are the richer the opportunities we can together develop with other cultures and communities.

There is a risk that because infrastructure and hardware can scale up so easily we will assume that culture and pedagogy will scale up in the same way. There is, however, also, concern that, whilst these new players are to be applauded for supporting learning with mobiles, their priorities and values differ from those of the older players; scale, sustainability and impact will now feature much more. In this new ecology of learning with mobiles, these factors mean that some forms of mobile learning, identified in our earlier account, will now thrive whilst others will perish.

Closing Remarks

This chapter is perhaps more speculative and problematic than its companions in the current book. It lies in the space between the specifics and the details of lived projects and pilots and the broader abstractions and understandings needed by the worlds of commerce and policy and complicated by issues of culture and community. Unlike other attempts to discern trends and generate recommendations that could come from the mobile learning activist, researcher and developer communities aimed at ministries, corporations and agencies; the domain is those different and distant worlds of *international development,* rendered ever more fluid and volatile under the transformative impact of ubiquitous, universal and pervasive mobile technologies.

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3

Universal Instructional Design Principles for Mobile Learning[1]

Tanya Elias

Abstract

The report extends a previous analysis of universal instructional design principles in distance education, by applying them to the design of mobile learning. Eight principles with particular relevance for distance education are selected, and their recommendations are discussed in relation to the design of educational materials for a range of mobile devices. The problems and opportunities of mobile learning are discussed, and the need for educators to focus on the content design issues rather than on searching for the next new technology.

Introduction

In a previous publication, the current author discussed the value of Universal Instructional Design (UID) principles for use with the learning management system, Moodle. The current article extends the discussion by discussing the application of UID in mobile learning (m-learning). M-learning has been championed as “a personal, unobtrusive, spontaneous, ‘anytime, anywhere’ way to learn and to access educational tools and material that enlarges access to education for all” (Kukulska-Hulme and Traxler, 2005, p.1). It also been described as having the potential to “reach people who live in remote locations where there are no schools, teachers, or libraries” (Ally, 2009, p. 2). This ability to reach new audiences in new places is particularly relevant in the developing world where mobile cellular penetration has more than doubled since 2005 and the adoption of mobile

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devices has outpaced the use of personal computers and landline Internet access (ITU, 2010). Thus, mobile devices are rapidly becoming the key to making information "universally accessible" (Wellman, 2007). In order to realize its potential, effective methods for offering high-quality and accessible m-learning are required.

Although a single definition of m-learning remains elusive, Traxler (2009) has stated: mobile learning exploits both handheld computers and mobile telephones and other devices that draw on the same set of functionalities. Mobile learning using handheld computers is obviously relatively immature in terms of both its technologies and its pedagogies, but is developing rapidly. It draws on the theory and practice of pedagogies used in technology enhanced learning and others used in the classroom and the community. (pp.11-12)

To date, m-learning research in both the developed and developing world has focused on the use of handheld computers and smartphones (Kukulska-Hulme and Traxler, 2005; Ally, 2009). In contrast, little research has concentrated on m-learning for simpler devices and/or those capable of running on limited networks (Trifonova and Ronchetti, 2003). After a successful pilot using simply featured phones, Gregson and Jordaan nonetheless referred to "the potential uses of the more recent smartphone and 3G handsets for supporting a broader range of academic activity within education in Africa (Gregson and Jordaan, 2009, p. 225). Similarly, Ford and Leinonen have identified a desperate need for a new approach, particularly in the developing world environment. The model needs to take into account issues of usability, accessibility, and affordability, while ensuring that appropriate pedagogical models are adhered to ...(Ford and Leinonen, 2009, p. 198). Thus, m-learning has much in common with traditional forms of face-to-face and online learning with respect both to its pedagogy and its use of technology. The current paper suggests that UID principles developed for other forms of learning can also be helpful in designing inclusive m-learning applications accessible to the largest possible audience from the simplest of devices.

The Challenges and Opportunities of M-Learning

M-learning design presents unique challenges as follows:

1. Device variability. Neilsen (2009) identified three categories of handheld mobile devices: feature phones with tiny screens and numeric keypads; smartphones that include an A-Z keypad and a mid-sized screen; and touch phones featuring a device-sized screen and activated by touch. Despite recent market excitement about the potential of higher-end smartphones and touch phones, feature phones continue to represent an estimated 85% of the mobile market. The significant challenges of m-learning are partly due to this diversity. As Stead (2010) has explained,

> There is no single solution to push richly interactive mobile content onto every possible phone. Rather, there is a spectrum of possible solutions: On one side, going for the richest possible interactivities...and on the other side going for the widest possible phone coverage. (para.3)

In many m-learning pilot projects, this challenge has been overcome by distributing to learners a specific mobile device and designing for that device. Students, however, generally want to learn on their own mobile devices (Bradley, et al., 2009). Moreover, Herrington A, Herrington J and Mantei (2009) point out that "using a learner's own device ensures that many of the features of the devices are well known and practiced(Herrington, et al., p. 136).

2. Slow download speed and limited Internet access. Despite advances in the delivery of mobile cellular broadband in North America and Europe, download speeds on mobile devices continue to present problems. These are compounded in regions of the world where high- speed broadband access is expensive and/or completely unavailable (ITU, 2010). To this point, most m-learning pilot projects have provided free access to the highest available level of mobile Internet access, although this approach is not in tune with the realities facing a large proportion of users, particularly in the developing world.

3. Small screen sizes with poor resolution, color, and contrast. On hardware designed to fit in a pocket, small screen size continues to be a defining feature of handheld mobile devices. A typical screen size is 8–12 centimeters long and 6–8 centimeters wide with the presentation usually being in portrait mode but sometimes in landscape. Resolutions vary and may or may not involve back-, front- or side-lit images with color (JISC, 2010). Neilsen (2009) estimated that the average success rate for accessing Web sites from feature phones was only 38%. Smartphones and touch phones fared moderately better with success rates of 55% and 75% respectively.

4. Awkward text input. Regardless of the device being used, inputting text data into small devices also presents challenges for the user. Inputting information into a device using a numeric (0-9) keypad on a feature phone continues to be tedious and time consuming. Again, the more sophisticated the device, the better its input capabilities.

5. Limited memory. Handheld phones have limited internal information storage capacity or memory. Extra random access memory (RAM) for the storage of programs and files may be added to devices from external memory sticks or cards (JISC, 2010), although these cannot be inserted into all handheld devices. Moreover, Kukulska-Hulme and Traxler (2005) pointed out that it takes slightly longer to retrieve data from external memory by comparison with internal memory—a fact that still applies five years later. In contrast, read-only memory (ROM), which runs the device operating system, cannot usually be increased (JISC, 2010).

But m-learning design also presents a distinctive set of opportunities as follows:

1. Relatively inexpensive m-learning opportunities. Although cost remains a barrier to m-learning in many parts of the world, handheld mobile devices and cellular services are significantly less expensive than PCs and laptops with fixed Internet service (ITU, 2010). During a pilot project in Africa, Ford and Leinonen found that if "the phones used were basic models and only needed to support the ability to send an SMS, the cost factor for the handset was small" (Ford and Leinonen, 2009, p. 225). Moreover, the size and inherent portability of the devices facilitates information sharing as a method of lowering access costs more easily. In fact, Kreutzer (2009) found that for many young South Africans, mobile phone handsets are quickly becoming the Internet platform and multimedia device of choice. Moreover, he noted that not owning a phone "does not seem to create a 'mobile divide' or automatically lead to exclusion from the possibilities of mobile Internet access" (Kreutzer, 2009, p. ii).

While the hardware devices themselves may be relatively inexpensive, network access can present additional challenges. Ramos, Trinoña and Lambert (2006) found in the Philippines that 81% of those surveyed would be willing to set aside a portion of their prepaid cell-phone credits for learning. Although cost will continue to present a barrier to m-learning for some populations, the entry point for this type of learning is potentially much lower than for forms of online learning.

2. Multimedia content delivery and creation options. Mobile devices allow sound, text, pictures, and video files to be downloaded to the device and uploaded from the device. In addition, they feature built-in speakers and, almost always, cameras. Ford and Leinonen used a mobile audio-wikipedia that supported increased access to information in a region "where the access to information, both paper-based and electronic, is limited" and built on "the strong African oral tradition" (Ford and Leinonen, 2009, p. 210).

3. Continuous and situated learning support. Mobile devices allow ongoing learning to occur in multiple locations, including the potential to offer scaffolded support (Saye and Brush, 2002) to learners undertaking authentic tasks. Using these devices in a way that maximizes these learning benefits has the potential to offer educational opportunities that are both more inclusive and of higher quality. As Nyíri (2002) has explained:

> Mobile communication is enhanced everyday communication; and just as our everyday conversation is indifferent towards disciplinary boundaries, so, too, is m-learning. Situation dependent knowledge, the knowledge at which m-learning aims, by its nature transcends disciplines; its organising principles arise from practical tasks; its contents are multisensorial; its elements are linked to each other not just by texts, but also by diagrams, pictures, and maps (Nyíri, 2002, p. 124).

UID Recommendations for M-Learning

UID principles have been developed to build flexibility of use into both the instructional design and operating systems of educational materials so that they will be appropriate to the widest range of students (Connell, et al., 1997; Scott, et al., 2002; Burgstahler, 2007). Elias (2010) extracted from these eight UID principles particularly useful in distance education (DE):

- equitable use;
- flexible use;
- simple and intuitive;
- perceptible information;
- tolerance for error;
- low physical and technical effort;
- community of learners and support; and
- instructional climate.

Although not specifically developed for m-learning environments, these are equally relevant to them. The relevance of almost all of these principles for designing inclusive online learning is further increased when designing inclusive m-learning. Table 3.1 compares the most relevant recommendations arising from UID principles for online learning with a series of additional recommendations for m-learning.

Table 3.1 UID Recommendations for Inclusive M-learning

UID principles	Online DE recommendations	M-learning recommendations
Equitable use	• Put content online • Provide translation	• Deliver content in the simplest possible format • Use cloud-computing file storage and sharing sites
Flexible use	• Present content and accept assignments in multiple formats • Offer choice and additional information	• Package content in small chunks • Consider unconventional assignment options • Leave it to learners to illustrate and animate courses
Simple and intuitive	• Simplify interface • Offer offline and text-only options	• Keep learners' interfaces simple • Keep code simple • Use open sites and software
Perceptible information	Add captions, descriptors and transcriptions	
Tolerance for error	• Allow students to edit posts • Issue warnings using sound and text	Scaffold and support situated learning
Low physical and technical effort	• Incorporate assistive technologies • Consider issues of physical effort; • Check browser capabilities	Use available SMS reader softwares and other mobile-specific assistive technologies
Community of learners and support	• Include study groups and tools • Easy-to-find links to support services	• Encourage multiple methods of communication • Group learners according to technological access and/or preferences
Instructional climate	Make contact and stay involved	• Push regular reminders, requests, quizzes and questions to students • Pull in learner-generated content

1. Equitable use. Course content should be accessible to people with diverse abilities and in diverse locations. With respect to m-learning, this involves developing content and assignments that can be accessed on a wide variety of devices. As a result, to develop accessible m-learning, one ought to do the following:

- ***Deliver content in the simplest possible formats.*** SMS or texting technology is cheap and its high levels of penetration are almost universally accessible. Mitchell (2002) identified "simplicity of use, relatively low cost and the asynchronous nature of SMS, which gives people time to reflect before responding to a message [as] undoubtedly part of its phenomenal success". Issham et al. (2010) found a high level of acceptance of SMS-learning as "safe, easy, effective and usable to help them in their studies" (p. 14). JISC (2010) has described SMS as a classic example of an "m-learning accessibility model. Although it poses all kinds of physical and usability barriers to disabled learners the motivation for using it is sufficiently high that there are few who do not actively manage to master it to some extent".

  There are numerous ways to address these accessibility issues (see item 6). Developing primary content using SMS can be a simple yet elegant way of ensuring that diverse learners have access to required materials. Wijayanto (2006), for example, designed an SMS-based public education system to both inform the public and to gather information regarding avian flu.
- ***Use cloud-computing file storage and sharing sites.*** Given the small storage capacity of most handheld devices, file-storage sites may offer users the same level of flexibility in completing assignments as is available to those with more sophisticated hardware and/or connectivity. A study at a South African high school, for example, indicated that only 33% of students had access to phones with substantial internal and flash-card memory. This led "to the regular deletion of older content in order to make room for new material" (Kreutzer, 2009, p. 69). Using external storage sites would enable these students to save more information, develop more complex projects, and engage more fully in learning.

2. Flexible use. According to this UID principle, course design should accommodate a wide range of individual abilities, preferences, schedules, levels of connectivity, and choices in methods of use. As with other forms of inclusive learning, inclusive m-learning should offer choice in how materials are used. SMS-based m-learning offers fast transmission of information to students who are bound to neither a computer nor a classroom. Whereas other types of education go to great lengths to simulate real-world situations and to bring the outside world into the classroom through the use case studies, role-plays, photographs, videos, and so on, m-learning has the potential to bring the learning out of the classroom to remote students. SMS-based solutions may often be more than adequate for this but will require significant adjustments.

- ***Package content in small chunks.*** Clearly, the use of an SMS system, with its 160 character limit, forces content to be brief. The length of resources needs to be considered in taking download speed and costs into account. Bradley et al. divided materials into "manageable learning chunks" (Bradley, et al., 2009, p. 281) and separated text over several screens. Although, seeking out such ways to package content may present challenges, it may also have pedagogical advantages for all learners owing to the elimination of dead wood—information that is not essential for attaining a learning goal (Smith and Ragan, 2005).
- ***Consider unconventional assignment options.*** Suggesting and accepting unconventional assignments allows learners to look for unique ways to use the multimedia features of their devices and to compensate for the hardware's shortcomings. In the South African project, for example, the inclusion of multimedia options led to audiocasts that "were passionate and uninhibited and included spontaneous harmonizing of songs, including rap songs" (Ford and Leinonen, 2009, p. 207).
- ***Leave it to learners to illustrate and animate courses.*** In contrast to traditional teaching environments where instructors are predominantly responsible for incorporating the real world into the classroom, mobile devices have the potential to transfer that responsibility to the learners themselves. Using phones with cameras/video capabilities, students can capture their own material and instantaneously send them to other students and instructors and/or upload it for storage. Discussion could then revolve around real-world examples defined by the learners.

3. Simple and intuitive. Unnecessary complexity should be eliminated and course design rendered simple and intuitive. As already mentioned, the simplest mobile delivery system is currently SMS. To post and share their own multimedia content, however, learners must access multimedia messaging systems (MMS), e-mail, and/or a mobile Internet service. When developing and/or selecting existing sites for use, the following guidelines are useful:

- ***Keep learners' interfaces simple.*** It should be ensured that they contain only information that can fit comfortably on the smallest of screens.
- ***Keep code simple.*** Sites that use HTML provide a simple and relatively accessible content delivery system with useful features including the

ability to link between pages and sites. Use of simple coding minimises files sizes, increases download speeds, and is better supported on feature phones that may not give good support for cascading style sheets and other advanced programming functions.

- ***Use open sites and software.*** Open sites and software help to ensure that learners have ongoing access to resources and lower costs. Ford and Leinonen state that this facility “stimulates the local IT sector in a country, which is crucial in developing countries to ensure full participation in the information society” and “allows software to be customized to local conditions by the communities themselves” (Ford and Leinonen, 2009, p. 199). The use of open-source products, therefore, advances not only simple access to content but also (relatively) simple access to m-learning development tools.

4. Perceptible information. With respect to this UID principle, one of the recommendations for online learning is to add captions, descriptors, and transcriptions (Elias, 2010). SMS-based materials would not require these added features. Instructors may encourage learners to include them, however, when their assignments include media elements. Nevertheless, it is likely that not all student-posted materials will be accessible to all users. Strategies are suggested to mitigate these issues (see item 7).

5. Tolerance for error. UID principles also minimise hazards and adverse consequences of errors in software operation by designing learning environments with a tolerance for error. While m-learning errors are likely to be similar to those encountered in traditional online learning, an additional m-learning-specific recommendation may be identified:

- ***Scaffold and support situated learning.*** M-learning is uniquely positioned to support situated learning (Lave and Wenger, 1990). In many settings, it may be valuable for learners to be able to access learning materials via their mobile device while performing a task or skill. In these cases, job performance aids included in the learning package may reduce learner errors by providing just-in-time training and support as and when required. Providing simple, short text-based support in rich learning contexts has an excellent educational potential.

6. Low physical and technical effort. As with online learning, m-learning should be developed requiring a low technical and physical effort. The physical effort related to inputting text into devices is therefore a primary concern. Clearly answering test essay questions on such a device would be tedious if not impossible. As indicated in relation to SMS usage, the difficulties associated with inputting text data into mobile devices pose the challenge of developing new, authentic, and inclusive forms of assessment. In addition, inclusive m-learning should seek out opportunities to do the following:

- ***Use available SMS reader softwares and other mobile-specific assistive technologies.*** Several SMS readers are freely available with potential value to learners who are visually impaired, who are auditory learners, or who are studying while driving. A clip-on magnifier can easily be attached to increase font size and visibility (JISC, 2010). An external device to convert SMS to Braille was developed in the Philippines (Estopace, 2004) but may not be commercially available today.

7. Community of learners and support. As in other forms of learning, community support for learning should be facilitated through the development of groups and support from appropriate tools.

- ***Encourage multiple methods of communication.*** Learners should be encouraged to experiment with the standard communication options of mobile devices (SMS, e-mail, instant messaging, and voice communication) in developing relationships with and support for one another. Using these features, they can scaffold one another (Saye and Brush, 2002) in working collaboratively to theorise and solve ill-structured real-world problems.
- ***Group learners according to technological access and/or preferences.*** In the development of inclusive m-learning, it is likely that diverse learners will have differing levels of access to and interest in multimedia technologies. It may be preferable to combine learners into groups along these lines. For example, if some learners use only SMS text in a course, they may prefer to work together rather than with learners who have access to MMS and/or Internet. Grouping students in such a way may reduce their sense of "missing out" on specific delivery features.

8. Instructional climate. This UID principle focuses on the instructor's impact in course delivery as opposed to course design. M-learning instructors can send regular SMS messages to interact with learners in various ways. For example, they can do the following:

- ***Push regular reminders, requests, quizzes, and questions to students.*** Instructors can easily generate and send reminders about assignments, weekly expectations, and interactive quizzes using SMS (Ramos, et al., 2010). Such systems can be effective in generating discussion and in inviting various forms of student feedback.

- ***Pull in learner-generated content.*** As instructors push their content out, they can continuously pull in student-generated content in various forms (SMS and MMS, audio files, pictures, videos, etc.). Regardless of the hardware, the key is for the instructor to foster an inclusive environment that supports learning through sharing and collaboration in which the contributions of all learners are valued.

Conclusion

Inclusive and accessible education should aspire to include all learners. Mobile learning appears to have the potential to do that. SMS and MMS technologies offer excellent opportunities to open up education to many who have long been excluded from it. This effort, however, will involve the development of creative techniques for relatively simple technologies and the design of universally accessible educational materials for them. The challenge will force educators to rethink their current approaches to teaching. They should not look exclusively for the next great technological advance but rather should focus on the accessible design of materials using tools that are currently available. Intensive research is needed to consider the ways in which appropriate technologies and solid pedagogical approaches can remove the barriers to educational diversity. The principles of universal instructional design will play a valuable role in this process.

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4

Planning for Mobile Learning Implementation

Amit Garg

Abstract

While mobile learning has had a slow start, it is now starting to feature in most strategy discussions within Learning & Development (L&D) teams in large and small enterprises. Even though some large organizations have started using mobile technology to empower their workforce, for most others the question still remains—how do we actually use it in the workplace? Training departments are still unsure how to design, develop and implement a successful mobile learning (mLearning) strategy that works for their organization.

A successful mLearning implementation is to be preceded by a thorough understanding of mobile learning itself. This is further supported by some pre-defined implementation steps that cover assessment of needs, content strategy determination, and design and security considerations. Finally, it's when the rubber hits the road when the actual value of mLearning can be determined.

Introduction

Buddha says, "An idea that is developed and put into action is more important than an idea that exists only as an idea."

Mobile Learning as a term has been around for almost a decade now; however, it still remains a relatively new domain for most. While the benefits of adopting mobile learning are easily appreciated, implementation has been a challenge for organizations—both small and big. Additionally, the rapid pace at which the mobile domain is evolving makes it even more challenging for organizations to create a comprehensive long-term mLearning strategy. This chapter will look at how some of these challenges in implementing mobile learning can be overcome; however, it is important to understand mobile learning better. This will make it easier to implement the right kind of mLearning solution for organizational training.

Understanding Mobile Learning

Mobile learning myths abound, from “it is just eLearning on the phone” to “it is very costly to implement”. Most of these emanate from poor understanding of mobile learning. To understand mobile learning better, it is important to learn about the three key principles of mobile learning.

1. Mobile everything. The first key principle comes from the uniqueness of mobile devices. In his book *Mobile as 7th of the Mass Media*, Tomi Ahonen (2008) calls mobile devices as the 7th Mass Media. The first six are Print, Recordings, Cinema, Radio, TV, and the Internet. He also lists the following eight unique benefits of mobile devices:

- the first personal mass medium;
- permanently connected;
- always carried;
- built-in payment channel;
- available at creative impulse;
- the most accurate audience information;
- captures social context of consumption;
- enables Augmented Reality (AR).

A few more media can be added to this list like audio/video recording and playback, gaming device, and the growing list of sensors that mobile phones have started featuring; these include motion sensors, accelerometers, and more lately Siri in iPhone and NFC(Near Field Communication) in Galaxy SIII and some other devices. All of these features allow training administrators to deliver much more than just traditional courses on mobile devices. This is captured beautifully in the graphic (see Figure 4.1) below (Brown, et al., 2010) while listing the various activities or tasks that can be done on mobile devices.

Figure 4.1 Mobile Learning Tag Cloud

So the first key principle of mobile learning is—Mobile learning is much more than just learning. Maybe it should be called as "mobile everything" for want of a better word.

2. Mobile augmentation. The second key principle of mobile learning is "mobile augmentation". Clark Quinn (2011) in his book *Designing mLearning: Tapping into the Mobile Revolution for Organizational Performance* talks about the applications/usage of mobile learning. Quinn (2011) says "...mLearning should be viewed as augmenting your learning or performance..." This broadly captures the essence of mobile learning. To augment performance learners can have checklists, reminders, and just-in-time look up of help files, media, or get connected with an expert in real time. To augment formal learning, training administrators can provide some pre-course nuggets to bring all learners to the same level. Administrators can also let participants engage in a "back channel" conversation to build on their understanding of a training session. In addition, they can consider providing post event assignments, summaries, and discussion opportunities with co-participants.

3. Mobile context. Imagine a learner standing in a crowded train holding the rails with one hand. Imagine an electrician working atop an electric pole to resolve a snag that's occurred—he is literally hanging from the ropes around him, and with his gloves on; he is unable to type on his phone. The idea is pretty clear. The third key principle is about "mobile context".

It is crucial to remember that, more often than not, learners will access mobile learning when they are away from their normal workstation or in situations where access to PCs or other similar devices is impractical or impossible. The context in which they will access mobile learning will then dictate the designing of the mobile learning solution/s.

To reiterate, the three key principles of mobile learning are

- mobile everything (or much more),
- mobile augmentation, and
- mobile context.

As mentioned earlier, these key principles if understood and practiced well, should help in creating better mobile learning solutions.

Six Steps to Successful Mobile Learning Implementation

After understanding the key principles, it gets easier to move into implementation of mobile learning. Listed below are six key areas, which need to be addressed.

1. Establishing the need. This is fairly obvious, but it's surprising how often it is ignored. Some early mobile learning initiatives have been taken up more for novelty value than for real needs. That's probably due to lack of understanding of what mobile learning is and how best to use it in the workplace. All organizations irrespective of their size or nature of business can benefit from mLearning provided the real needs of an organization are identified and then the most appropriate solutions can be implemented. Mobile learning should not be implemented just because it's the "in thing" or because everyone else is doing it.

Asking the questions listed below can help in identifying the real need for mobile learning:

- Is providing training to the mobile workforce difficult?

Mobile workforce could constitute the sales staff, senior executives who are usually traveling, field support staff who visit client sites to troubleshoot and resolve issues, and individuals handling similar profiles.

- Is mobile the only/best way to provide training/learning access in some cases?

For senior executives, providing training in a classroom or via eLearning is not an option. They would rather like to have nuggets of learning material made available, which could be quickly searched and accessed just when they need it. There are other cases, as with large multinational companies having presence in the developing world, wherein there are higher chances of their staff working in locations from where they can connect to the Internet only using a mobile phone.

- What is the objective of adopting mobile learning? What are the business goals?

Is transferring some of the existing training programs to mobile the only agenda or is there something bigger? Is there an opportunity to reduce errors by providing checklists on staff's mobile phones? Can the response of the sales staff be improved by making Customer Relationship Management (CRM) available on mobile devices? Can safety be better implemented with checklists on mobile devices?

2. Assessing organizational readiness. Once the real need has been established, an organization's readiness for mobile learning needs to be assessed. This could be on the following several fronts:

- ***Management.*** Management buy-in is crucial for the success of any initiative. Below are a few questions to assess the management readiness:

- Does the senior management understand and appreciate the potential of mLearning?
- Are they willing to spend time and money on creating a worthwhile strategy/plan for mobile learning in the organization?
- Are they using mobile devices for accomplishing business tasks?

• ***Audience.*** The profile of the staff is important for a successful implementation. Though not always true but in general, the older staff could be more reluctant to using mobile devices for learning. Also, if the staff does not operate computers nor have accessed eLearning in the past, they may be slow to adopt mLearning. One should ask these questions:

- What kind of mobile devices does the staff currently use?
- How do the learners use their mobile devices?
- Are they ready to do some learning on the mobile devices? If yes, what topics and in which situations?

• ***Culture.*** Closely linked with the audience profile is the culture of workplace. As mobile devices are always on and available at the "point of impulse", mobile learning enables informal and social learning. As the mLearning initiative matures, social and informal learning could pan out to be the biggest and the most important element of an organization's mobile learning strategy. One should ask:

- Is there a culture of sharing, commenting, social learning in the organization?

• ***Does it fit in the learning strategy?***

- How will mLearning be leveraged in the organization?
- Does the learning strategy already include a mix of social, informal, and performance support?

3. Devices and platforms to support. Mobile platforms (or operating systems) are jostling for larger share of the pie with Apple's iOS and Google's Android together ruling the market as of now. However, Windows Phone 8 looks promising and is knocking on their doors, and even Blackberry, with its upcoming v 10, is refusing to give up just yet. Gary Woodill (2010) had estimated different types (platform & make) of mobile phones at over 5,000 in his book *The Mobile Learning Edge*.

Mobile devices with screen sizes ranging from 3.5 inches to 10 inches should be included in the choice matrix, as all sort of tablets too feature in the mix, and for good reasons. Why? Because even though tablet learning is fundamentally not the same as eLearning or mLearning, it is actually the biggest driver of mobile learning in the workplace. The learning delivered on tablets is different in terms of the context in which the devices for eLearning, mLearning and tablet learning are used and the purpose for which the learning is being done. A word of caution here—organizations should not think only iPads when planning for mobile learning on tablets. iPad is not the only tablet around and its market share may reduce in time to come as more people adopt Android and even Windows based tablets.

Today, there's a wide range of screen sizes to cater to. In fact, it is a multi-screen world today, with more and more people using more than 2 screens during the day to accomplish their tasks. People are using their phones intermittently even while they are working on their desktops or laptops. Even at home, multiple screens are simultaneously in use—typically a phone or a tablet along with the TV. In a recent report from Google (2012), 77% of the times viewers watch TV with another device—49% with a smart phone and 34% with a PC/laptop. It is not too much of a concern as of now, but gradually people will expect their media to transcend between the multiple screens. Online advertisers are now beginning to implement solutions around this.

Organizations that can afford to provide mobile devices to their workforce find mLearning implementation relatively easy, but not all organizations can afford to do that. Typically, the companies that are providing devices to staff are starting with just their sales staff or other specific sections of their workforce. A related trend is to allow staff to use their personal mobile devices for business (aka BYOD – Bring Your Own Device). In many cases, the staff has already started using their personal devices for work in absence of a clear policy from the company. There are pros and cons of the BYOD movement and the actual adoption of these devices for mLearning needs to be evaluated. Well-articulated BYOD policies in the learning strategy will help in managing this effectively.

4. Development and delivery models. Closely linked with the choice of platforms and devices are the development and delivery options available for mLearning. There are several options to choose from and there is no single, clear winner. Following are some thoughts on choosing the right development and delivery model for organizational training:

- ***Native app or mobile web?*** These days, like everyone else, the Learning & Development staff is influenced by apps and using them for everything one can imagine. And they cannot be faulted as the world has adopted the use of apps ever since the launch of the iPhone. The excitement around apps is easily carried to the training and learning domain by the Learning & Development staff themselves or their bosses in some cases.

Native apps provide a great user experience and utilize device capabilities, however creating them is costly. Else the choice between native apps and mobile web was really quite simple. As Jakob Neilsen (2012) in his bi-weekly column on web usability (Alertbox) points out—"currently native apps are the best in delivering top notch experience, if you can afford it. In future, however, mobile web will be the best". In context of mLearning, native apps should be preferred over mobile web when the staff needs to access information in low/no connectivity areas or needs to perform specific operations, which need to use the devices' native capabilities like camera or higher processing capability. Web-based approach, on the other hand, is great if the organization needs to support a wide range of devices and platforms, and doesn't need either offline access or device specific features.

Cross platform development tools provide a middle ground between native apps and mobile web. In some situation, they may work very well; however, there are common issues like lack of support for all features of platforms and slower performance than native apps, which compromises on the user experience. In the long term, as the cross platform tools continue to evolve, they will meet almost all the development needs.

- ***Flash vs. HTML5.*** This is actually not a point of debate anymore. For any web-based mLearning, HTML5 is the future of mobile web, even if it's not ready to the extent it is believed to be. However, the choice is still to be made when eLearning is to be created for the desktops. If making learning materials available on tablets or other mobile devices is not on the organization's agenda, HTML5 may not be the best option as Flash still delivers the best experience for desktop learning. Also not all browsers are ready for HTML5, and besides a lot of enterprises still have IE(Internet Explorer) 6, 7, & 8 as their primary browsers.
- ***Authoring tools.*** Most authoring tools actually struggle to provide real HTML5 compatibility. Several of them actually just embed non-interactive videos in HTML code. Good quality animations and interactivities are still missing. The tools are expected to become more capable in exploiting the potential of HTML5 in the future. If a mobile learning delivery and management product was to be implemented, some of the existing ones (like Upside2Go) offer inbuilt authoring tools

as well. Of the tools available out there, Lectora, Articulate Storyline, and Adobe Captivate look most promising to get the development done. Some of these also provide options to publish as Flash or HTML5 or as an app.

- ***LMS integration.*** If mLearning adoption is being done for the right reasons, LMS (Learning Management System) tracking is not necessary, leave alone SCORM (Sharable Content Object Reference Model) compliancy.

  Recalling the three key principles of mobile learning, it is easy to identify that a lot of what would be categorized under mobile learning does not need tracking or is not trackable. Qualcomm, for instance, tracks its mLearning initiative just like it would track its website—completion or competency is not measured (Oakes, K. and Polaschek, J., 2012). This webcast from ASTD covers Qualcomm case studies. The URL for the webcast is http://www.youtube.com/watch?v=DPukN2_tsbA&feature=youtu.be.

  Also, tracking of SCORM components have been difficult on mobile devices due to technical complexities such as, no facility to open multiple browser instances or having framesets. Moreover, there is an additional challenge of tracking of activities that are carried offline. This is because there is often a switch between connected and not connected states with mobile devices. However, vendors have found a way out to such issues and have implemented SCORM compliancy on mobile devices by creating apps or wrapper apps. These apps store all offline information and communicate to the LMS when online, as per SCORM requirements.

  Tin Can, also known as "the experience standard" is an important development in the area of tracking of mobile learning. It is the next version of SCORM and allows tracking of even informal learning activities.

5. Defining content strategy. When starting with mLearning, most organizations try to convert their existing eLearning to mLearning. While this could be a great starting point and does work well especially if the mobile devices targeted are full size tablets, it should be adopted with caution. It's not recommended to go blindly about eLearning to mLearning conversion without a thoughtful consideration. Mobile learning is not "just eLearning on the move" but is much more and very different too. As mentioned earlier, while describing the three key principles of mobile learning, it is best to use mobile learning to augment learning or performance of the staff (Clark Quinn, 2011). And that could significantly change the way the content for mobile learning is considered.

- ***Four types of content.*** Chad Udell (2012) in his recent book, *Learning Everywhere: How Mobile Content Strategies Are Transforming Training,* talks in great detail about the four types of content in the context of mobile learning. His book is highly recommended for getting some illuminating thoughts on mobile learning from a practitioner's point of view. Next is a summary of the key content types.
  - *Conversion of existing content from other sources.* This could be the starting point with mLearning. One needs to identify the best existing content and repurpose it to deliver an optimized version on targeted devices.
  - *Social.* In most probability, the staff is already learning on social networks. The learning strategy of an organization can be aligned with that and leveraged for the organization's benefit. A platform that allows the staff to capture their moment of creative impulse and share thoughts, pictures, or videos with colleagues will help generate meaningful content and in the process allow them to learn from each other.
  - *New affordances.* One should think about the new possibilities brought about by mobile devices, like GPS data that help sales professionals with contextual information, or augmented reality (AR) view of an engine bay for the technical staff. Further, one can look for ways to support the staff in getting their tasks done faster, better, and with lesser errors—all with the help of their mobiles.
  - *Line of business applications.* A new world is opening up with inline help, intelligent wizards, and contextual information in applications. In general "mobility in enterprise" is gaining momentum and Learning & Development Departments can leverage that to deliver some relevant content. Typically, the sales teams can get in the enterprise mobility solutions first.
- ***Responsive learning design.*** Creating and delivering content on different devices necessitates a content strategy that helps optimize the training efforts. Typically, an organization would want to create once and publish/deliver on many different platforms. Trends in website design are helpful to track when creating web-based mLearning. Traditionally, websites that started being as "fixed layout" moved on to "fluid layout", which adjusts the display according to the screen size.

More recently “Responsive design” concept is becoming popular. It allows the web pages to reformat and edit the content on them to suit the screen size of the device from which it is being accessed. It features “fluid grid” and “content & design driven media queries”. So, if a webpage is designed using responsive design methodology and is accessed from a 4-inch mobile device or a 7-inch tablet, the page would be laid out differently and some content (e.g., big images) may not be displayed as against that seen on a desktop or laptop. The key point to be kept in mind when designing mobile learning with responsive design methodologies is to retain the instructional integrity of the content on all device sizes and also account for the fact that contexts of access could be different for different devices.

With multiple-screens becoming the norm in which today’s staff lives and works, learning content needs to be created that can transcend from one device type/size to another. Again, context and user experience would be paramount.

6. Managing security concerns. Security of an organization’s propriety and confidential content is one of the key aspects that need to be managed well when mobile learning is considered from a long-term perspective. For web-based mobile learning, a login-protected access coupled with data encryption is sufficient to manage major security concerns. However, app-based mobile learning, where the learning resources are downloaded onto the learners’ devices, needs more stringent security arrangements. In addition to screen locks, auto-timeouts, password-protected access to the content inside the apps, data encryption, solutions such as Mobile Device Management (MDM) and Mobile Application Management (MAM) are of great help. These can prevent any unauthorized access and even provide a facility to effect a “remote erase” on lost devices.

The US military has initiated a program called Connecting Soldiers to Digital Applications (CSDA), which focuses on delivering training and performance support to soldiers via smart phones. This snippet can be found in the article by Gould and Biron (2012) entitled “Security Concerns Hobble U.S. Army’s Mobile Learning”. Defense News points out how they are approaching the security issues—“The Army is pursuing a solution that sidesteps the security issue in a sense, one that ensures that these consumer smartphones access data without storing it. This way, if a device winds up in the wrong hands, it cannot be hacked into and exploited”.

So for organizations beginning with mobile learning and facing security as a big hurdle, web-based mobile learning is the best option for them to start with.

Getting Started

The knowledge of the above six steps can help in implementing mobile learning successfully in an organization. However, getting started could still be a challenge. Below are some thoughts to get mLearning in action.

Mobile Learning Strategy is a Moving Target

While this chapter was being written, the world was still guessing if the iPad mini would be launched as a real product or if it was just a rumor. By the time the chapter was complete, the iPad mini was released. Similar was the case when the new iPhone was launched and Samsung released Galaxy SIII mini with a very similar screen size. iPhone 4 features "Siri" while Samsung Galaxy SIII features "S Voice" and NFC, Nokia's latest range features "City Lens". All these are examples of some amazing new features that the devices of today are equipped with and which can be leveraged for mobile learning initiatives. The pace of change in the mobile domain is so rapid that it is near impossible to make a comprehensive long-term strategy for mobile learning.

Conclusion

Although mobile learning is a seemingly complex learning technology, given its newness and rapidly evolving nature, escaping it is not a choice anymore, especially for organizations that wish to bolster their employees' performance and progress in midst of tough competition.

The best way to get started with mobile learning is to "just do it". It's good to start small. One can

- do something simple for a select team;
- target any low-hanging fruits;
- put some content online and optimize for mobile access;
- make some performance support checklists or knowledge nuggets available on mobiles;
- convert a complex calculation to a mobile app;
- create a reminder pocket book to support a 3-day training workshop.

What is important is — "Do anything, but do it." It's the experience of doing it that is what helps plan better and bigger. More importantly, it allows an organization to grow its mobile learning initiative in line with the domain itself by incorporating the latest features to the level at which it can assimilate them.

To keep in step with the evolving mobile domain, it is imperative to review the mLearning initiative often, obtain feedback from learners and their supervisors, look for areas of improvement, identify success that can be replicated elsewhere, and use this information to close the loop.

This chapter has sought to help organizations wanting to implement mLearning as a part of their organizational L&D activity. While the possibilities in mLearning and the domain per se will continue to evolve, it is important that organizations initiate mLearning. This experience and learning will help them fine-tune their strategy better and implement mobile learning from a long-term perspective.

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5

Blended Mobile Learning: Expanding Learning Spaces with Mobile Technologies

Agnieszka Palalas

Abstract

Mobile learning has a potential to transform learning spaces and go beyond the traditional physical and conceptual boundaries of education. This chapter presents a reflective overview of how the affordances of mobile tools combined with the ubiquitous character of m-learning and the nomadic tendencies of mobile learners open up new territories of knowledge construction. Five conceptual spaces of mobile learning are identified as the essential elements of the m-learning ecosystem, including (1) temporal, (2) physical, (3) transactional: intrapersonal, personal, and interpersonal (social and public), (4) technological, as well as (5) pedagogical spaces. While some of the characteristics of those spaces are discussed, the emphasis of the chapter remains on their blending and the opportunities presented by the overlaps and interrelations of these areas. It is proposed that blending of these vital elements of the m-learning ecosystem results in discrete learnable moments, the sum of which in turn constitutes unique mobile learning space. Accordingly, the most favorable balance of the m-learning spaces would form the optimal m-learning zone combining resources (information and actors), contexts, processes and supports that result in enhanced learning. Mobile devices offer capabilities to explore and appropriate these m-learning spaces for the purpose of gaining new knowledge, skills and experience.

In addition, this chapter re-defines blended learning in the m-learning context and discusses both the opportunities as well as some challenges resulting from the blended approach and blurring of space boundaries.

Introduction

Mobile learning strategies and technologies have expanded the possibilities of knowledge building by blending boundaries between the various elements of the teaching-learning relationship and supporting the more dynamic interplay of the integral components of the learning ecosystem. The escalating adoption of mobile technologies has engendered a significant shift toward mobile computing and communication which has permeated all aspects of our students' life. Consequently, learners are willing and expect to be able to work, learn, and socialize outside of the temporal and spatial limitations. In fact, the boundaries between working, learning and socializing have been blending thus affecting the way people learn and negotiate meaning across the various aspects of everyday life. *Blending*, indeed, seems to be one of the main characteristics of the 21st century learner-centered educational theory and praxis.

In this chapter, it is proposed that blending of the vital elements of the mobile learning ecosystem results in discrete learnable moments, the sum of which in turn constitutes unique mobile learning space. The overlaps and interactions between what is called here physical, temporal, transactional, technological, and pedagogical spaces can produce a combination of resources (information and actors), contexts, processes and supports that promote learning. The most favorable balance of the mobile learning spaces would thus form the *optimal m-learning zone*, revisited and illustrated in the Blending Mobile Learning Spaces section below. Mobile devices offer capabilities to explore and appropriate these m-learning spaces for the purpose of gaining new knowledge, skills and experience. Hence, with facilitation and guidance of experts, mobile tools can effectively mediate the interplay of these elements toward successful learning outcomes.

A short overview of the aforementioned mobile learning spaces begins in the next section, followed by a re-definition of blended learning. Then each category is revisited and its relationship with the other spaces is discussed in more detail. Some challenges resulting from the blended approach and blurring of space boundaries are signaled in the last section before the conclusion of this chapter.

Mobile Learning Spaces

While the notion of space has been addressed in the m-learning literature (Arminen, 2009; Kukulska-Hulme, et al., 2011; Squire, 2009; Traxler, 2011), not much discussion has been devoted to the intersection of these integral worlds. Kukulska-Hulme and colleagues (2011) in their discussion of context vis-à-vis mobility, refer to physical, conceptual, and social space, amongst other elements of the m-learning system. Traxler (2011) talks about the interplay of digital and physical worlds and how it may impact both identity and context. Likewise, de Souza e Silva (2006) examines the relationship between physical and digital spaces and how they compose connected hybrid spaces. Bearing in mind the overlap and connections of the mentioned categories, this chapter has attempted to separate the most vital dimensions of the m-learning ecosystem into the following key conceptual spaces (see Table 5.1).

Table 5.1 M-learning Spaces

M-learning space	Space dimensions/definition	Examples
Temporal space	Time and length of learning: idle time or an event/activity during which learning takes place; both brief ad-hoc learnable moments and more substantial stretches of learning (When? How long? Within what time limits?)	Between classes, during a bus ride, while walking a dog, during a lecture
Physical space	Place, position, location* of learning including geographical coordinates, layout, pertinent circumstances, physical context (containing context-embedded information) and limitations of the location (Where? What layout? Within what physical limits?)	In the classroom, on the bus, in a line-up, at home, at a museum
Transactional space • Intrapersonal • Personal • Interpersonal (social & public) (see Figure 5.2)	**Intrapersonal space:** the activities taking place within the individual self and internal learning processes occurring within the individual mind; the intimate zone of "my own private space within" **Personal space:** an intersection of intra- and interpersonal regions; zone where interactions with external actions, artifacts, information, tools occur; the intermediate zone of "my own external private space"; individuals still do not enter into a transaction with others but they interact with the learning environment and its elements *Intrapersonal and personal are both **private spaces*** **Interpersonal (shared) space:** the social and public regions within which learning takes place, with ***public space*** being the broader zone (interaction and association with larger audiences) and ***social space*** being reserved for sharing, exchange and communication within an established or ad-hoc community (Who? With whom? For whom? From whom?)	**Intrapersonal:** thoughts, ideas, reflections, communications, processes internal to an individual **Personal:** email, individual/single-player mobile edu-game, reading a book, watching TV by oneself, listening to a podcast, writing, taking pictures **Interpersonal:** city, classroom, Facebook, MOOC, train, café, mobile game

Table 5.1 (Continued)

M-learning space	Space dimensions/definition	Examples
Technological space	Mobile learning technological enablers including mobile tools, connectivity and network/web, computational power, software capabilities. Technological space includes ***virtual space*** where digital information is stored in the network or personal devices, and where interaction between that content, technology and its users occurs (How? Using what tools?)	Mobile apps, Internet, telephony, built-in camera, Wi-Fi, cloud computing, augmented reality
Pedagogical space	Learning theories and approaches including strategies, activities, and procedures, as well as content and materials, scaffolds and supports (How? Why? What? Who? What m-learning design? What materials?...)	Situated learning, activity theory, ecological constructivism, context-aware activities, assessment tasks

* for the purpose of this discussion three-dimensional extent excluding time

These are not all-encompassing categories but the most vital ones in this discussion of the blending present in the mobile learning ecosystem. Before the relationships and blurring of the five spaces in the mobile world is considered, the definition of blended learning is debated below.

Blended Learning Redefined

The broadly applied definitions of blended learning refer to combining multiple instructional methods and instructional modalities (or delivery media), as well as mixing face-to-face (f2f) and online learning (Graham, 2006). The term *blended learning* was in fact popularized in 1998 to denote "the mixture of e-learning and classroom learning" (Masie, 2006, p. 22). Given that understanding, all computer-assisted learning can be considered blended learning. In fact, Masie posits that "[a]ll learning is blended learning" (Masie, 2006, p. 22) as any knowledge or skill acquisition involves a combination of delivery methods, strategies, materials, context and other elements of the learning system. He concludes that "[b]lended learning is imperative. It reflects the blended nature of our world, our workforce, and the natural process of how people really learn" (Masie, 2006, p. 26).

Indeed, with the advent of mobile technologies blended learning has expanded beyond the ICT-f2f mix and evolved to encompass a number of overlapping dimensions. In view of the ubiquitous access to resources, people, and tools, selecting and blending pertinent components of the learning ecosystem are not only doable, but it is actually essential to a satisfactory learning experience. Learners, with guidance form experts, can select what is appropriate for their unique place, time, and context, as well as their interest, level of preparedness and objective of learning. With such choice, individuals can personalize their learning experience by mixing and matching what works:

> [M]agic is in the mix. [...] The magic is the power of adding two or more learning elements. Learners have always known this. They have been blending learning for thousands of years. They add what is missing, they mix it with what they need, and they subtract what it's not valuable. They socialize it. They find context. And they transform training and instruction into learning. (Masie, 2006, p. 26)

Mobile learners can thus leverage mobile technologies and connective broadcasting to create learning episodes across physical and temporal spaces, across private and shared environments; they can apply a mix of technologies and select a blend of resources, people and learning strategies. While engaging with a combination of custom-made, off-the-shelf, real-life or self-generated learning artifacts and materials, learners can traverse the boundaries of virtual and physical worlds. Drawing on digital information and social networks, individuals enrich their understanding of the real-life context around them. Consequently, learners negotiate the relationship of the virtual and physical realities and their own role across the blending spaces. They enter into learning transactions with their peers, experts, and other people to make meaning through communication and mediation. Such blended mobile learning encompasses learning activities which may be formal, non-formal or informal, incidental or purposeful, spontaneous or planned. Mobile learning extends the notion of blended learning beyond the traditional learning spaces, methods, materials and actors.

Blending Mobile Learning Spaces

The various elements of the m-learning ecosystem meld into a unique place where the learning would emerge. The intersection of the physical, transactional, temporal, pedagogical, and technological spaces forms mobile learning space which may further produce the optimal m-learning zone: the most favorable interplay of the five components (see Figure 5.1).

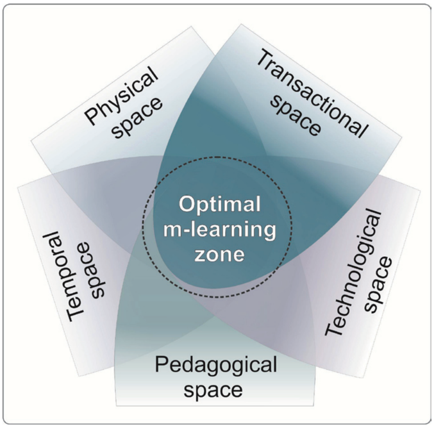

Figure 5.1 Blending Mobile Learning Spaces

Changes in one area of the system affect the behavior of the other elements. For instance, a learning activity which is potentially doable at a time-place point and within the technological realm might not be attainable due to the limitations of the transactional zone in which the individual is operating in at the time. Regardless of the presence or absence of wireless connection, the learner might not be ready to enter into a meaning-making transaction with other people (for instance, exchanging her ideas with others) and instead would prefer to externalize her cognitive processes by recording a personal audio note on the phone. At a later time, she might be willing to share the recording through a blog but be restricted by the confinements of a lecture she is participating in (temporal-physical space). The next few paragraphs take a closer look at the individual mobile learning spaces and how they blend and interrelate to enable learning on the go.

Temporal Space

Mobile learning takes place both within schedules and outside of any time restrictions. It may be structured as a component of in-class instruction or designed as a time-flexible or time-bound learning task. It can be a brief event, a series of learning episodes, a lengthier activity, or a combination of the three types. A learning activity may start at a moment in time, be paused when necessary, and then restarted when convenient or when the time is more conducive to knowledge building—when the user isolates a learnable moment. An individual can choose, or be guided, to take learning across time boundaries to effect rehearsal and reflection or to situate practice in a unique context that provides additional support for learning processes. In addition, a mobile learner can negotiate time confinements and continue certain learning activities seamlessly throughout the day.

With the emergence of mobile computing, people have increasingly used their interstitial time and space to learn. Mobile learners use the opportune time between two events such as classes, meetings, waiting for a bus and riding on a train for interstitial episodes of learning. In those micro-spaces, which become their personal learning time, individuals can listen to a podcast, watch video, answer an email or complete an assessment task. However, these time-independent snippets of learning alone would not necessarily result in a complete meaningful learning experience. For actual knowledge construction to occur, these chunked-up individual activities should be combined with more focused m-learning tasks often attached to a particular space at a particular time and as such being context-dependent . Moreover, m-learning involves navigating out of intimate time-and-place regions to social and public spaces, as discussed in the following paragraphs. In fact, effective design of mobile learning calls for a blend of self-paced individual activities with flexible group interaction and collaborative real-life tasks that might have to be completed at dedicated time and place (Palalas, 2012).

Hence, the temporal space of a mobile learner is a multifaceted territory populated by interstitial learnable moments, time-bound events, as well as extended periods of learning. Knowledge construction occurs across these zones as they interact with other m-learning spaces, starting with the physical space.

Physical Space

"[F]or mobile actors time and space are recurrently and systematically interwoven and inseparable (Arminen, 2009, p. 104). Similar to the time boundaries, the limitations of place-bound learning can be traversed with the help of mobile technologies, thereby offering a range of settings that may prove appropriate for mobile learning. Contingent on the learning objective, learners may prefer or be directed to a location-based practice which would benefit from the context-based information and interaction. Then, other times, they would utilize ad-hoc interstitial situations to reach for their mobile devices and engage in intervals of learning. Mobile learners hence mix location-based with location-flexible practice and consequently context-dependent with context-independent learning.

Such flexible navigation across the physical space is possible by means of mobile computing. The technology has a potential of augmenting traditional classroom instruction with engaging out-of-class practice. It can also transform the classroom into a blended learning student-centered experience.

Accordingly, individuals may access and document information while in the classroom, revisit it later in a relevant learning context (for instance, their field practice), and afterward enrich that content with learner-generated artifacts at the time and place of their choosing. They can engage with data and people or create content in one context, only to make meaning and sense of that information later at a more applicable or convenient place. Ubiquitous access to the mobile device, the web and other people may turn nearly any location into a "learnable place", especially if the combination of the other m-learning spaces (i.e., temporal, transactional, technological, and pedagogical) is advantageous.

Mobile learning, however, is not merely about delivering content or resources to students' devices wherever they are. It is "about the process of coming to know and being able to operate successfully in, and across, new and ever changing contexts and learning spaces...and knowing how to utilize our everyday life-worlds as learning spaces" (Pachler, et al., 2010, p. 6). By mediating interaction with spaces and communication with facilitators and peers, mobile devices enable meaningful engagement and exploration of the real-world learning contexts and situations. Mobile devices help connect facts and experiences, individuals and others, here and there, making these relationships worthwhile. The just-in-time and just-in-place learning is further enhanced by digital augmentation of information, including context-sensitive and location-aware data along with more general resources available on the web.

In context-aware mobile learning, the learning is often bounded to the confines of the when and where the activity takes place, for instance a visit to a museum building or cultural venue (Traxler, 2011). Interactions with the context might take the form of "artistic, expressive, creative and literary creations; reviews, responses and reactions to the environment, all specific to the locality and the context, all specific to their creators" (Traxler, 2011, p. 4). This situated experience promoting context-dependent knowledge would often be preceded by preparatory activities occurring at a different time and different location possibly using other tools. For actual learning to take place, the learning process might have to continue beyond the context-embedded learning task into follow-up activities: iterative information and feedback manipulation leading to reflection and eventually to meaning making. The physical and temporal contexts of the cumulative steps of the m-learning process would shift, thus expanding and blurring the learning space boundaries. The various contexts would become a part of the interaction and knowledge negotiation.

Mediated by mobile tools, interaction with the context of learning is vital to effective learning; it promotes meaning making through the perception and navigation of context affordances (Palalas, 2012). Authentic tasks embedded in the real-life situations and places promote learning enriched by cultural and practical knowledge. Situated learning may be supported by m-learning tasks which, in contrast to the de-contextualized classroom-based learning, include "settings and applications that would normally involve the knowledge learned" (de Jong, et al., 2008, p. 43). The notion of the learning context and its role in mobile learning is extremely complex and goes beyond the physical place and circumstances of the physical space; therefore it deserves a more in-depth treatment outside of the scope of this chapter. Nevertheless, it's worth emphasizing that the portability and flexibility afforded by mobile technologies is an enabling factor for learner-centered m-learning activities crossing over spans of time and locations, and over the realms of formally organized and spur-of-the-moment learning. The next section examines the blend of formal, informal and non-formal extents of learning which has been one of the essential characteristics of mobile-enabled learning (Kukulska-Hulme, et al., 2011; Sharples, et al., 2007).

Formal, Informal, and Non-Formal Learning

Mobile devices and aptly designed m-learning activities can, indeed, facilitate seamless transition from formal educational environments to non-formal and informal learning. Learning takes place all the time either intentionally or spontaneously, either pre-planned and scheduled or ad-hoc. As proposed by Scheerens (2009), non-formal learning is viewed here as any organized educational activity occurring outside the formal system. While in non-formal learning individuals are usually aware that they are learning, in an informal learning context, knowledge creation occurs less consciously (Scheerens, 2009); the process could be tacit and unstructured. Informal learning, "any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria" (Livingstone, 2001, p. 4), takes place outside structured educational or training activities, and it's usually not prearranged or strategically designed. It does not involve a formal recognition system and occurs "naturally" in everyday life and professional practice. In the lifelong continuous process of informal learning, individuals acquire "skills, attitudes and knowledge that derive from their daily activities as well as from the multiple contexts they experience" (Lucas and Moreira, 2009, p. 327). They may be engaging in a number of learning activities across different contexts and spaces, requiring more than one technology at the same time. That combined with the multitasking and multimodal character of such learning process and a need for on-demand access to resources, peers and experts renders mobile devices the appropriate tools for informal learning. In fact, the notion of informal learning has been often interwoven into the recent discussions of mobile learning (Jones, et al., 2012; Laurillard, 2009; Pachler, 2009).

As already mentioned, mobile technologies conveniently connect to a myriad of resources and enable on-the-go communication with other individuals. At the same time, they mediate interaction with the context (Palalas, 2012) making use of impromptu unstructured learning situations, thereby providing more structure and support to informal learning and transforming it into blended learning (de Jong, et al., 2008). Hence, by offering a convenient access to information and to “intentional and accidental learning episodes” (Naismith, et al., 2004, p. 18), mobile devices afford a “just-in-case” supports for unplanned knowledge construction episodes. Records of learning and information move with the learner availing themselves to further support and link formal, non-formal, and informal learning. Moreover, multimedia tools residing on handheld devices help learners capture knowledge-building evidence and create their own learning artifacts. Access to the networked space helps them synchronize their resources and activities leading to seamless blending of formal learning with that outside a dedicated educational context and curriculum.

Mobile learning strategies developed in the formal educational setting, under the guidance of experts, can be then transferred to real-world locations and situations to promote ongoing acquisition of new knowledge, skills and experience. Mobile technologies can thereby enhance knowledge and competence building either directly by means of a purposeful m-learning activity or indirectly by enabling the development of metacognitive skills and personalized learning strategies that learners will benefit from when new learning opportunities arise. Lifelong learning habits would then derive from mixing purposeful and impromptu learning activities completed across a variety of physical spaces.

Physical and Virtual Space

The discussion of physical space would not be complete without mentioning virtual realities and digital data they avail. The physical and virtual environments serve as reciprocal sources of information, exchange and interactivity. Connected over the network, users may enter the “hybrid space” constructed in the intersection between the electronic and physical worlds (Santaella, 2009) to discover a unique learning zone which draws from the two sources. “A hybrid space is *not* constructed by technology [but] built by the connection of mobility and communication and materialized by social networks developed simultaneously in physical and digital spaces.” (de Souza e Silva, 2006) Mobile technology however, plays a crucial role of mediating the interaction of these worlds creating new opportunities for gaining new knowledge and skills. To further enable learning, hybrid spaces move with the mobile learner disregarding any physical space boundaries.

Augmented reality capabilities are one of the aspects of the virtual world that encapsulate the impact that the blend of physical and digital world might have on knowledge creation. Not only do AR applications overlay information onto the real world but they also instantly respond to user input. Thanks to this interactivity learners can “construct new understanding based on interactions with virtual objects that bring underlying data to life” (Johnson, et al., 2012, p. 29). Augmented reality has strong potential to offer a new experience of the world, occasionally referred to as “blended reality” as well as *in situ* learning experiences involving exploration and discovery of the connected nature of information in the real world (Johnson, et al., 2012).

Blending of physical and virtual space also brings about the personalization or at times “invasion” of public space—converting it to private. It occurs when individuals “temporarily appropriate public space for personal use” (Squire, 2009) by connecting through their mobile devices to the virtual world yet disconnecting from the reality they inhabit. That might lead to developing a “personalized media environment that is attached to the person and not the physical place” and consequently to the “remediat[ion of] our sense of place and thereby gain[ing] control over our surroundings in new ways, effectively creating hybrid spaces that are neither public, nor private but both” (Squire, 2009).

Transactional Space

Transactional spaces span across the intrapersonal, personal, and interpersonal (social and public) territories (see Table 5.1 above). Learning occurs both within and across the penetrable boundaries of these spaces by means of communication and exchanges between them. Connective technology is a vehicle carrying information, artifacts, processes, and feedback back and forth, and hence combining the results of activities occurring within the transactional regions (Figure 5.2).

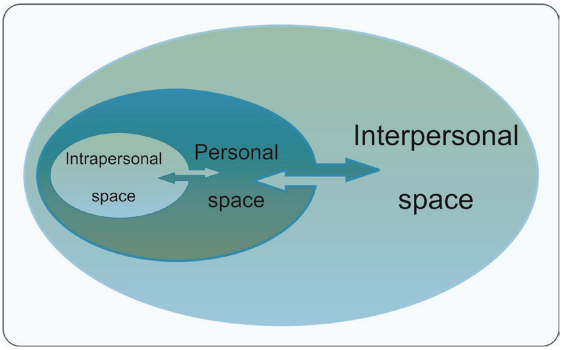

Figure 5.2 Interaction of Transactional M-learning Spaces

The transaction of learning is triggered by intrapersonal (cognitive) processes. Hence, privately initiated thought is shaped and validated by social and cultural mediation derived from repeated interaction with the context (Palalas, 2012) as well as communication with other people (Vygotsky, 1978). To progress through the evolving process of knowledge construction and achieve independent performance, interactivity should be also combined with the scaffolding support of an expert: facilitator, peer (Vygotsky, 1978), or a group. Social networks and other connective capacities of the web do offer that support: when needed, individuals can join an ad-hoc or organized community of learning and exchange information, questions, opinions, and help. However, before learners are ready to navigate through the shared social and public spaces, they might choose to stop over in the "safer" *personal* zone not inviting any exchange with other individuals yet. This is the time to interact with the technology, content and physical space before entering into any interpersonal transaction. In that intermediate space, learners can engage in writing, recording their thoughts, listening to podcasts, or taking photos of the environment around them. Mobile tools can thus mediate the vital relationship between private cognitive processes, social interactions, public spaces, and the context in which the learning takes place; they can also offer choice of when to move into which space.

Personalized learning experience and personal ownership of the learning tool are yet another significant benefit offered by mobile technologies. This capacity affords learning experiences adaptable to individual needs of diverse learners. Ubiquitous access to information and multimedia resources facilitates customization of the m-learning experience driven by learners' interests and preferences.

Squire (2009) observes that mobile device capabilities allow individuals to personalize their communications opting for e-mail, voice-based or text-based channels depending on their preferences and circumstances. Similarly, users can personalize their audio and text-based libraries based on their choice or recommendations "proposed" by software as iTunes or Amazon. Learners have a myriad of resources available to them including open-source tutorials, podcasts, lectures, educational games, and other materials, such as MIT's open courseware. Such wide selection in mobile media and flexibility in accessing these resources enables personalization of learning. Consequently, it promotes student-centric learning driven by the unique interests of the individual or a group. Students further personalize their learning by authoring their own materials, documenting their ideas, expressing their views and eventually, when they feel ready, exchanging them with their peers.

Accordingly, personalized practice repeatedly steers out of the private space in search of answers, insights or stimulating conversation. Learners come out of their personal workspace to interact with others and thus complete the learning process. Constructing personal micro-spaces allows learners to experiment and experience cognitive processes in a non-threatening environment before they are willing to share their private space with others. Students interact with content, create, revise, refine and re-create their own knowledge artifacts before they are ready to publish them. The same tool they use to create their personalized content, namely the mobile device, provides a channel to connect their private spaces with shared knowledge spaces. Through the flexible platform of the mobile network and its many tools (such as collaborative platforms, shared hashtags, voice conferencing, authoring tools) learners then enter into the knowledge co-construction relationship which expands beyond their private realm and helps them generalize the facts and processes they observed—from intrapersonal cognitive processes they traverse the transactional spaces to joint activities engaging multiple users and multiple modes of interaction even as public as citizen journalism.

Technological Space

Mobile technology has been interwoven into each paragraph of this reflection on the mobile learning ecosystem and its spaces as a *sine-qua-non* component. The capacities of the increasingly convergent mobile technology encompass portable mobile devices with their multiple built-in functionalities and tools, connectivity and access to the web, telephone and social networks, as well as the software capabilities and computational power of these technologies and their infrastructure. In addition, technological space enables the aforementioned virtual space where digital information is stored in the web or personal devices, and where interaction between that content, technology and its users takes place.

While mobile technology is the key player in the m-learning system, some learning tasks benefit from a blend of mobile and non-mobile devices, for instance using both mobile technologies and computer software to develop, publish and share artifacts (Herrington, et al., 2009). Thus, by engaging mobile and wireless technologies, but not excluding non-mobile tools, individuals can activate interstitial micro-spaces and also participate in the connected learning exchange. They can access the what, when, where and who choices offered by the blend of mobile learning spaces.

Pedagogical Space

Side by side with technology, sound pedagogy is the fundamental enabler of any learning. Mobile learning literature has explored the appropriateness of a number of learning theories and teaching approaches including inquiry learning, situated learning (Kukulska-Hulme, et al., 2011; Kukulska-Hulme and Traxler, 2005; Pachler, et al., 2010), socio-constructivist and conversational approaches (Sharples, et al., 2009; Sharples, et al., 2007; Palalas, 2012), or activity theory (Pachler, et al., 2010), just to mention the most frequently addressed ones. The central notions that accompany the discussion are context-embedded, real-world practice, learner-centered, ubiquitous, collaborative, personalized, technology-mediated, learner-generated artifacts, and inquiry. In fact, Kearney and colleagues (2012) proposed and tested an m-learning pedagogical framework which identified three major theoretical constructs: authenticity, collaboration and personalization. Considering the multiplicity of needs combined with strategies, activities, content and materials, as well as scaffolds and supports available in the mobile learning space, the “magic” would be in a dynamic blend of approaches.

So and Bonk, in their discussion of the roles of blended learning in higher education, observe that while blended learning approaches have been increasingly more frequently implemented in various educational settings, “relatively little attention has been paid to learning design technology, selecting appropriate modes of interaction, and designing activities based on robust learning theories” (So and Bonk, 2010, p. 190). They continued, however, that while many instructional decisions were still made based on availability of technology, blended learning research shifted focus to how pedagogy supports learning technology. For example, Osguthorpe and Graham (2003) and Graham (2006) [as cited by So and Bonk (2010)] refer to different types and levels of mixing within the pedagogy of blended learning, including activity level, course-level, and program-level blending.

All in all, the question remains what pedagogical elements to combine into m-learning activities. The ingredients and mechanics of the blend would depend on the complex interchange of the five mobile learning spaces, on the actors involved and the learning objective which guides the design of the pedagogical space. The traditional theories of teaching and learning need to be re-conceived to account for the convergence "between the new personal and mobile technologies and the new conceptions of learning as a personally-managed lifelong activity" (Sharples, et al., 2007, p. 224).

Challenges of Blending M-Learning Spaces

A range of opportunities enabled by the blended approach to mobile learning have been examined thus far and the complexity of the integration of mobile spaces has been considered. That complexity results in several caveats, some of which are signaled in this section.

First, blurring of physical and virtual worlds may produce bleeding between the two realities. Disregard for temporal confines also adds to the confusion of public and private behaviors. Similarly, negotiating individual's micro-space across the private and public realms may generate tension.

Second, the immediate learning experience of the here-and-now context becomes diluted as "[m]obile devices are reconfiguring the relationships between spaces, between public spaces and private ones, between public and private contexts, and the ways in which these are penetrated by mobile virtual spaces, and a growing dislocation of time and place"(Traxler, 2011, pp. 4-5).

Third, "the increasing vagueness in moving from evaluating a classroom lesson, to a school museum visit, to personal or family museum visits, to personal mobile learning across formal and informal settings" (Vavoula and Sharples, 2009, p. 55) poses challenges to capturing and assessing learning across contexts.

Fourth, the multidimensional nature of mobile learning spaces and their blends requires new theories, models, and frameworks to guide effective teaching and learning practice. Accordingly, experiential PD programs are needed to instruct teachers in mobile technology, m-learning strategies, and also in employing a blend of approaches targeting the specific m-learning goals (Ferry, 2009).

Some other challenges that require further investigation include (1) ethical issues in integrating and evaluating m-learning caused by the blurring of the spaces, (2) threats to identity and personal presence, (3) negotiating of social norms of blended m-learning, and, last but not least, (4) restrictions to blending mobile learning that arise, on the one hand, from the unequal access and, on the other hand, from the pervasive nature of mobile technology.

Conclusion

Mobile learning has a potential to transform learning spaces and go beyond the traditional physical and conceptual boundaries of education. Mobile learners can traverse different learning spaces to construct and co-construct their learning experiences.

This chapter has presented a reflective overview of how the affordances of mobile tools combined with the ubiquitous character of m-learning and the nomadic tendencies of mobile learners open up new territories of knowledge construction. Five conceptual spaces of mobile learning were identified as the essential elements of the m-learning ecosystem. While some of the characteristics of those spaces were illustrated, the emphasis of the discussion remained on their interaction and the opportunities presented by the overlaps and interrelations of these areas. The ensuing mobile learning topography encompasses the following spaces: (1) temporal, (2) physical, (3) transactional: intrapersonal, personal, and interpersonal (social and public), (4) technological, as well as (5) pedagogical.

It has also been proposed that the intersection of these spaces results in a unique m-learning space: the optimal m-learning zone. Further research is needed to explore what optimal conditions within the integral m-learning spaces would produce effective learning. What "magical" blends of these spaces would promote the acquisition of new knowledge, skills and experience — the "just-in-space learning" ? What are the evaluation criteria of the effectiveness of blended m-learning? This will require new research studies to adopt the blended m-learning lens to be able to explore answers to these and similar questions.

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6

Mobile and Digital: Perspectives on Teaching and Learning in a Networked World

Barbara Schroeder

Abstract

What constitutes mobile learning? Can mobile technologies change the way we learn? How might course designers and instructors take advantage of these technologies? In this chapter, the author discusses the evolving field of mobile learning—its definitions, perspectives, strategies for teaching and learning—and provides suggestions for adapting instruction to meet the needs of mobile learners. Mobile learning is a complex and evolving field, requiring our attention and diligence in creating engaging and authentic instruction. Being mobile and digital is becoming more and more ubiquitous, yet how much do we really know about and integrate these tools and strategies in our teaching?

Introduction

On a recent road trip along the Oregon coast, I instinctively reached for my mobile devices to select restaurants, take and share photos, access directions, determine what to wear based upon the weather forecast, search for answers to questions, and stay in touch with my family, while continuing my work as an online instructor. During this trip, my mobile phone and tablet computer became indispensible and ubiquitous tools, helping me stay connected and make informed decisions that would have been difficult or impossible just a few years ago. Instead of taking my chances on selecting a restaurant based upon a physical inspection of the establishment and the menu, I could instantly access customer reviews and photos, peruse the menu, obtain directions, and even book a table online. Instead of telling my students I would be out of touch for a few days, I could remain visible and available, quickly responding to their questions and needs. Through the efficient use of mobile technologies, my world has become increasingly connected, interactive, and empowered through personal inquiry and communication.

These insights are important to consider as our paradigms of teaching and learning are being transformed from a traditional, situated, and lecture-based format to an on-demand, online environment, where learning is collaborative and socially constructed. They raise important questions, such as: What is mobile learning? How might we use the unique characteristics of mobile learning to improve learning? Are the distinctions between online learning and mobile learning becoming blurred? Can we use mobile technologies to transform the teaching and learning process, enabling lifelong learning skills? In this chapter, I discuss current definitions, perspectives, and aspects of mobile learning, how mobile technologies are being used today, how we might best plan for integrating mobile learning strategies, and how mobile technologies can transform how we view teaching and learning.

Defining Mobile Learning

The terminology "mobile learning" or "m-learning" has become a buzzword on college campuses. Many universities are involved in mobile learning initiatives, with predictions that this type of learning will bring a paradigm shift in higher education (Rajasingham, 2011). The focus of most of these learning initiatives is using mobile devices to enable learning. Therefore, mobile learning has been mainly defined as learning that takes place via a wireless mobile device, such as mobile phones or laptop computers. It has been argued, however, that mobile learning is not limited to a device, but something that occurs at almost any time (O'Malley, et al., 2003).

Winters suggests "mobile learning, as a concept, is currently ill-defined; it seems to be all things to all people" (Winters, 2006, p. 5), and Sharples says we lack "an innovative and enhancing educational framework for the mobile age" (Sharples, 2005, p. 1). Therefore, how might we expand and better understand the concept of mobile learning and apply mobile learning strategies to improve learning?

O'Malley's definition of mobile learning includes a learner-centered perspective, acknowledging the advantages of mobile devices:

> 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. (O'Malley, et al., 2003, p. 6)

Perspectives of Mobile Learning

Winters' (2006) four "perspectives" of mobile learning—(1) technocentric,

(2) e-learning, (3) augmenting formal learning, and (4) learner-centered learning—can help us further conceptualize the various dimensions of mobile learning. Although these perspectives are linked to mobile learning, "learning is learning", as one workshop participant noted, with the acknowledgement that "learning is mediated through mobile technologies, which are in themselves interwoven with other learning tools" (Winters, 2006, p. 8). These individual perspectives can provide course designers and instructors with valuable insights and strategies for using mobile technologies in designing instruction and improving learning.

The technocentric view is pervasive throughout the literature on mobile learning, focusing on learning through using a mobile device. Through this perspective, we are able to identify the advantages and disadvantages of various mobile technologies and to apply effective instructional strategies in using those technologies for learning. For instance, if a learning activity requires students take pictures and share using a photo sharing service or application, then the use of smartphones would be appropriate. If e-books are used in a course, then tablet computers would be a good choice. If students need to collaborate on a shared file, they might prefer to use laptops. As with all good instruction, once the learning objectives are identified (and this does not have to be solely the instructor's choice or static), then the best tool(s) can be identified.

When applying the second perspective, mobile learning as an extension of e-learning, we should investigate the options for including mobile access to the course and offer distinct mobile learning activities. We might start by analyzing if and how mobile devices are accessing our online space and determine the extent of the need for mobile access. Simply adding Google Analytics code to a course site will provide these statistics, enabling course designers and instructors the ability to view how course content is accessed. If students are accessing the course site using mobile devices, then this is a good indication of the need for mobile access. Mobile theme style sheets can enable students to view and interact with a course site on a smartphone, for instance, while a regular web-based view can be used with tablet computers. Additionally, many tablets now have the capability of using cellular networks to access the Internet, enabling users the ability to connect almost anywhere. These devices can also be used to create a personal Internet hotspot, connecting additional devices as needed. Ubiquitous computing is now becoming a reality.

The perspective of augmenting formal learning can be applied as an overall learning strategy to offer and extend informal learning activities outside of the classroom, whether face-to-face, hybrid, or online. Although formal and informal learning appear very similar on the surface, they are quite unique. Informal learning usually occurs spontaneously and is often fueled by person inquiry (Schroeder and Haskell, 2012). Vavoula (2005) found in a study of everyday adult learning that 51% of the reported learning took place at home or in the learner's own office at the workplace.

A fundamental characteristic of informal learning is the need for knowledge that is authentic, personal, and situated. Unlike facts about major battle dates, mathematical formulas, or ordered structures, the knowledge the learner is seeking is relevant and immediate and can impact his or her meaning-making (Schroeder and Haskell, 2011). Before the age of mobile technologies, information could be found, but often required more time and effort. Through encouraging and offering opportunities for informal learning, we can help learners view learning as dynamic and perpetual.

Finally, viewing mobile learning through the perspective of learner-centered strategies can empower both teachers and learners, allowing us to make the conceptual leap from traditional, lecture-based, teacher-driven instruction to learner-centered, where students take control of their own learning and better understand how and why they learn.

In order for students to embrace learner-centered learning, they need to be convinced that "learning is the central purpose of their schooling" (Doyle and Tagg, 2008, p. ix). Also, we need to help students feel comfortable with the idea of taking charge of their learning. Do our curricula and instruction send this message? Do we help students become critical evaluators of their learning, modeling learning that will last a lifetime rather than just learning for the test and then forgetting everything when the semester is over? Do students understand why we want them to learn in small groups? Do they know how to collaborate using online tools? Do students believe what they are to learn is important?

Weimer tells us that "college should be the time when and the place where students develop prowess as learners" (Weimer, 2002, p. 5). One of our most important tasks as teachers, she says, should be to help our students develop lifelong learning skills and the confidence to use them. Course content should evolve from covering content to helping students develop learning skills and an awareness of learning.

Developing a learner-centered approach in the classroom using mobile technologies requires knowing your students and helping them learn the skills they will need to use the tools. Because mobile technologies are inherently non-linear, interactive, and situated, students may need to learn new strategies and skills, such as how to search for information, how to evaluate that information, how to collaborate meaningfully online, and how to solve problems in various contexts. "One of the most important aspects of learner-centered teaching is that its focus includes preparing students for their future learning." (Doyle and Tagg, 2008, p. 10)

Social Presence in Mobile Learning

Another perspective from which to view mobile learning is social presence. Mobile devices are inherently social. They can be used to quickly communicate, share, and publish. We now know that social presence is an important factor in enhancing distance learning (Tu and McIsaac, 2002). Through the positive emotional effects produced through the process of learning, social presence can contribute to learner satisfaction (Gunawardena and Zittle, 1997).

Tu and McIsaac (2002) studied social presence in the online learning environment, examining dimensions of social presence using quantitative and qualitative measures. Three dimensions of social presence emerged: (1) social context, (2) online communication, and (3) interactivity. These elements were considered very important in establishing a sense of community. An interesting result of their study was the importance of privacy in online interaction. A sense of privacy increased the level of comfort for online students. Also, as social presence in the online environment improved, so did the level of online interaction.

Mobile technologies offer multiple opportunities and options for social presence and online interaction. For instance, video conferencing with mobile devices is available through many tools, such as Adobe Connect Mobile, Google Hangout, and Apple Face Time. Various voice chatting apps are supported in a mobile environment, to communicate either one-to-one or in a group. Some of these tools are text messaging (SMS), Twitter, Facebook, and Google Hangout. Collaborative writing tools, such as Google Docs, wikis, and blogs allow users to create, share, comment on, edit, and publish content. Publishing videos on video sharing services is now commonplace and quick, allowing us to be informed of current happenings. Sharing files, pictures, just about anything, is now just a quick click away. The potential for social interaction and learning through mobile technologies is compelling and profound.

Communication in Mobile Learning

As discussed, mobile devices offer ways to stay connected, with instant communication. How important is communication in learning? Sharples offers a compelling argument for learning as "conversation in context", describing a view of learning "as a process of 'coming to know' by which learners in cooperation with peers and teachers, construct transiently stable interpretations of the world" (Sharples, 2005, p. 2). These "interpretations of the world" can be enabled through virtual digital networks, affording learners the opportunity to "transcend barriers of age and culture" (Sharples, 2005, p. 2). He links learning to communication, citing educational theorist John Dewey:

> Not only is social life identical with communication, but all communication . . . is educative. To be a recipient of a communication is to have an enlarged and changed experience. One shares in what another has thought and felt and . . . has his own attitude modified. (Dewey, 1921, pp. 6-7)

Sharples challenges the current model of classroom education, based upon evolving digital technologies and constructivist epistemology, proposing that teachers should participate in learning as another learner, in the "conversation of learning" (Sharples, 2005, p 2). He contrasts the limited aspects of learning in a classroom to the "rich interactions" children experience inside and outside of the classroom, through mobile communication, texting, and participating in social networks. He talks about the need to create a negotiated process of learning, where children can bring their mobile devices to school, share their learning experiences, and even help define the curriculum. This type of learning as a "process to know", where learners, peers, and teachers cooperate to make meaning stems from a learning theory and epistemology most educational technologists are very familiar with—constructivism. Sharples suggests this view of learning also stems from radical constructivism, an epistemology coined by von Glasersfeld as a way of knowing:

> ...an unconventional approach to the problems of knowledge and knowing. It starts from the assumption that knowledge, no matter how it be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience. What we make of experience constitutes the only world we consciously live in...all kinds of experience are essentially subjective, and though I may find reasons to believe that my experience may not be unlike yours, I have no way of knowing that it is the same. (von Glasersfeld, 1995, p. 1)

And what about context? Good teachers know that creating instructional activities (conversations) within authentic contexts enhances learning.

Sharples describes learning as "conversation in context" (Sharples, 2005, p. 2). Through mobile learning, we are empowered to create multiple contexts, re-contextualize our learning, and to continually ask new questions. This concept of learning, moving from static to dynamic, can be a powerful game-changer in education. It can help move the learner and instructor from classroom-only learning to learning in multiple contexts and places, embracing new learning opportunities and in the process making new meanings. The continual forming and re-forming of knowledge is an essential characteristic of learning in a mobile, digital society.

Planning for Mobile Learning

Given what we know about mobile learning, how might we best plan for implementing its elements in instruction? We could start with Winters' perspectives (Winters, 2006), the importance of social presence, applications of constructivist epistemology, the importance of social presence, and Sharples' view of learning as "conversation in context" (Sharples, 2005, p. 2). In planning for mobile learning, we should have a good understanding of its definitions, perspectives, and theoretical underpinning. We can then use these understandings to guide us in the creation of engaging course content, activities, and assessments, with the goal of improving learning.

Learner needs are also an essential element in designing any type of learning, but perhaps even more so in a mobile setting. We need to know our intended learning audience and the tools they are currently using. We need to consider the settings in which they will be using the tools. Although it is often not possible or practical to survey students at the beginning of a course, it would be a good idea to have students answer a few questions about the types of mobile devices they have, their experience with them, what features they use, and where they will be using them. Will they have restricted access? Do they have the ability to send and receive text messages? What social networks do they prefer to use? What privacy issues might they have? When are they available for synchronous communication? What experiences do they have with online collaboration? These and other relevant questions can help the designer organize the course in a way that will be more beneficial for learning.

Ownership and Use of Mobile Technologies in the United States

It is also important to know current statistics regarding ownership and use of mobile technologies. It will probably come as no surprise that college students are some of the highest users of mobile technologies. Statistics from the Pew Internet & American Life Project 2010 show that nearly all undergraduate and graduate students use the Internet, with more than nine in ten undergraduate and graduate students having home broadband access, which is above the national adult average of 66%. Also, 96% of undergraduate students own a cell phone and 88% own a laptop computer. Graduate students have even higher ownership, with 99% of them owning a cell phone and 93% a laptop computer (Smith, et al., 2011).

Most people of all ages who own laptops connect wirelessly to the Internet. College students are much more likely than the overall cell phone owner population to use the Internet on their mobile phones, with undergraduate students being the highest percentage at 63%. Only 5% of both undergraduate and graduate students owned a tablet computer in 2010 (Smith, et al., 2011). Perhaps college administrators are aware of this statistic, as several colleges and universities in the United States are now providing free Apple iPads to their incoming freshmen. These devices, while less portable than a smartphone, offer the advantage of a larger screen size, enabling a better reading experience and Internet browsing. Additionally, tablet computers are more portable than laptops and offer interactive multi-touch screen technology.

Although most college students own cell phones, not all of these are smartphones—devices able to connect wirelessly to the Internet. However, nearly half (46%) of American adults were smartphone owners as of February 2012, an increase of 11 percentage points over the 35% of Americans who owned a smartphone in May 2011. Young adults tend to have higher-than-average levels of smartphone ownership. Smartphone brands owned are mixed, with 20% owning Android devices, 19% owning iPhones, and 6% Blackberry devices (Smith, et al., 2011).

Smartphones are also gaining popularity among teenage users. According to the Pew Internet Project's 2011 teen survey, 77% of teens have a cell phone. Almost one quarter (23%) of teens 12 to 17 indicate their phone is a smartphone, while over half (54%) have a regular cell phone. Another 23% of teens do not have a cell phone. Smartphone ownership is highest among older teens, with 31% of teens ages 14 to 17 owning a smartphone, compared with just 8% of children ages 12 to 13. Smartphone owners are also the most likely to be tablet owners. In the last 30 days, 88% of teens indicated they used the Internet on a desktop or laptop computer, 49% on a cell phone, 34% on an MP3 player or iPod, 30% on a game console, and 16% on a tablet computer or iPad (Lenhart, 2012).

These statistics provide compelling arguments for the use of mobile technologies in all schools. Although many middle and high schools attempt to limit or manage student cell phone use at school, a 2010 Pew Internet Project study found that 65% of cell phone-owning teens bring their phones to school every day (Lenhart, 2010). And 58% of cell phone-owning teens sent a text messages during class. Forty-three percent of all teens who take their phones to school say they text in class at least once a day or more.

Adapting Instruction for Mobile Learning

Knowing your learners, the devices they use, and the skills they possess for using them are essential in designing optimal opportunities and options for mobile learning. For instance, if you discover that all of your students own iPads, you might want to offer a textbook that is also available as an e-book. If your course is online, you will want to make sure it renders well in various mobile devices, so students can not only access course materials, but also communicate with students and instructor. If your course requires students take, share, and publish videos, you might suggest they use a smartphone or other portable Internet-capable device.

Also, you will need to know about current mobile technologies, what they can do, the applications that might support your learning objectives, and how to use them. This does not mean you need to know about every device and every application. However, once you identify your instructional objectives and begin to construct your learning activities, you should then begin to look for mobile tools and technologies that might support the learning. Here is an example:

Your instructional objective is: "Students will solve a type of math operation, recording and sharing their problem solving processes through a video sharing site." You would probably begin your instruction by explicitly demonstrating the problem solving skills you would use in the types of math operations you want them to learn, providing students with tutorial videos they can view multiple times on their mobile devices. In essence, you would be creating worked examples (Clark and Mayer, 2011) from which students could more effectively learn. Worked examples are particularly beneficial, as they can help free up working memory for learning. After students learn the process of solving the problem, then "practice becomes beneficial to help learners automate the new knowledge" (Clark and Mayer, 2011, p. 204). You would also want to include instruction on how to create effective multimedia instruction, using Mayer's multimedia principles (2002) to guide this instruction. Examples, non-examples, discussions, and other learning experiences would be a natural part of this preliminary instruction.

After introducing and discussing the objectives and activity, you might encourage students to research and report back on the various methods and/or tools they would use to create multimedia tutorials. Of course, their selection of the mobile tool(s) and application(s) would probably be limited to what you or your students have available. For instance, your students might decide to use a handwriting application on a tablet computer to record and narrate their steps and then share that file, making it accessible to the entire world. If you are teaching in a classroom with a SmartBoard or other interactive device that also records, students could use this tool and upload the files to a class site or video sharing service. Or, your students might decide to use smartpens to record lessons and then publish to a course site or video sharing service.

To enable teacher-student communication, you might want to use mobile technologies during certain days and hours. Free tools you could use might be Gmail Chat, SMS, Google Hangout, Face Time, or Facebook. If you need to share a handwritten note with your students while communicating in a virtual environment, you could use a mobile application that would display and share a whiteboard online in real time, as well as saving it and posting to Facebook or Twitter. You might investigate a web conferencing tool where you could write on a whiteboard while talking with your students and answering questions.

What makes these activities so powerful is that students are actively involved in their learning, using higher order cognitive processes—solving problems, planning for and creating video tutorials, publishing and sharing, analyzing the problem-solving skills of their classmates, and continually adding to their knowledge structures. Students are not only learning how to solve a specific type of math problem—they are learning the skills to solve problems and create effective multimedia presentations. Through commenting and other feedback, students can review the accuracy of their tutorial and perhaps be motivated to edit or create a new one. When using mobile technologies, the learning process can become much more collaborative and social, with students actively helping each other. Ultimately, this learning activity would enable students to organize and develop a rich resource of tutorials to help them review for tests and access information for future reference. As a bonus, the instructor would be able to reuse these materials.

Conclusion

Can mobile technologies transform learning and how we view learning? In the previous example, students were engaged in problem solving, learning how to create meaningful content and evaluating that content. Instead of students completing math problems in isolation, turning them in to the teacher, and receiving a grade, they are encouraged to tackle math problems in a collaborative, social environment, creating a teaching resource from that activity, sharing it with the class or a public audience, and then evaluating it from group feedback. Their work is not limited to the classroom, as all of the activities could be completed using a mobile device with either an Internet or cellular data connection. Students could feel confident they always had the support of their teacher, as she would be available virtually during specific hours. Additionally, students would be encouraged to contact other students for help or maybe work in pairs or groups to complete the tutorial. When new videos were added to the video sharing site, students would be able to instantly view them and provide feedback. It would be a continual cycle of learning, with students demonstrating their understanding through more complex and individualized processes.

As a teacher, you might ask, "But is this all worth it?" Empirical support for active learning and problem-based learning (PBL) is extensive. An exhaustive study of active learning found support for all forms of active learning examined. Prince found that positive outcomes result from instruction in problem solving. "While practice is crucial for mastering skills such as problem solving, greater gains are realized through explicit instruction of problem solving skills." (Prince, 2004, p. 7) This alone is an excellent argument for reducing the amount of repetitive math problems assigned to students, instead having them first develop problem solving skills and then be able to apply them to similar, yet different situations.

The best available evidence on collaborative learning suggests that instructors should structure their courses to promote collaborative learning environments. Studies also suggest that students will retain information longer and possibly develop enhanced critical thinking and problem-solving skills (Alavi, 1994; Hiltz, et al., 2000; Huba and Freed, 2000; Lowyck and Pöysä, 2001; MacGregor, 1990). Simply knowing how to use tools and knowledge in a single domain is not enough in today's digital world. Our students need to learn how to apply this knowledge in different domains and multiple situations.

A powerful aspect of mobile learning is the ability for the learner to interact with multiple types of media. Mayer's cognitive theory of multimedia learning (2002) can help guide course designers and instructors in creating engaging and effective multimedia instruction. Mayer tell us that active learning occurs when the learner engages in deep cognitive processing while learning, paying attention to relevant materials and mentally organizing this knowledge into a coherent knowledge structure. The creation of worked examples to help students solve types of math operations can not only help students learn how to solve a specific problem, but extend that learning to similar, yet different problems. Applying Mayer's multimedia principles can add to the quality of online instruction, while improving opportunities for learning.

Mobile learning, like all technology, will always be a work in progress. We have seen tremendous growth in the number of mobile devices and applications and will continue to see this trend. However, we must remind ourselves that mobile learning may mean different things to different people. But it is the devices and applications we use that make us mobile and digital. With the availability of cellular connectivity on tablets as well as smartphones, our abilities to compute on the go are becoming almost ubiquitous. Mobile technologies enable us to learn anytime, anywhere, continually asking questions and searching for answers. Will this method of learning eventually transform how we view learning? If we model the love of learning in our instruction, create engaging, active learning environments, and value questions just as much as answers, then we are on our way.

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7

Using mLearning and MOOCs to Understand Chaos, Emergence, and Complexity in Education[1]

Ignatia de Waard, et al.[2]

Abstract

In this chapter, we look at how the massive open online course (MOOC) format developed by connectivist researchers and enthusiasts can help analyze the complexity, emergence, and chaos at work in the field of education today. We do this through the prism of a mobile massive open online course (MobiMOOC), a six-week course focusing on mLearning that ran from April to May 2011. MobiMOOC embraces the core MOOC components of self-organization, connectedness, openness, complexity, and the resulting chaos, and, as such, serves as an interesting paradigm for new educational orders that are currently emerging in the field. We discuss the nature of participation in MobiMOOC, the use of mobile technology and social media, and how these factors contributed to a chaotic learning environment with emerging phenomena. These emerging phenomena resulted in a transformative educational paradigm.

Introduction

In December 1972, Edward Lorenz presented a paper to the National Academy of Sciences in New York, titled "Predictability: Does the Flap of a Butterfly's

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2. Other authors include: Sean Abajian, Michael Sean Gallagher, Rebecca Hogue, Nilgün Ozdamar Keskin, Apostolos Koutropoulos, Osvaldo Rodriguez.

Wings in Brazil Set off a Tornado in Texas?" This chapter introduced what we now know as chaos theory. Chaos theory was only emerging at that time, but it shook the scientific world as it helped describe outcomes for complex systems that were impacted by a variety of factors. As chaos theory became more widely accepted, experts in other fields, including educational research, started to employ it to predict future frameworks.

In the reality of the 21st century's second decennium, education is molded by a variety of new factors. The use of social media, new mobile technologies, and pedagogical formats has a major impact on the learning and teaching processes of today. Due to these new technologies and emerging formats, education has been forced into a process of transformation, and that causes an imbalance at first. However, Reigeluth (2004) writes,

> Chaos theory and the sciences of complexity can help us to understand our present systems of education, including (a) when each is ready for transformation, and (b) the system dynamics that are likely to influence individual changes we try to make and the effects of those changes.
>
> Once we understand the dynamics of these new processes, we can find a new educational balance.

In these times of great complexity, we believe a pedagogical format that embeds and even embraces this complexity, combined with a prevalent emerging technology, can be the means to arrive at a new educational order. In this case, the pedagogical format is a MOOC and the emerging technology is mobile learning (mLearning). We are certain combining technologies that embrace the complexity of knowledge production with pedagogical formats that allow learners to build knowledge by filtering that complexity will encourage a new educational balance to emerge. This balance will possibly enable the construction of a redesigned educational landscape that better fits this Knowledge Age. We use the word "possibly" to refer to Davis and Sumara's statement that "an education that is understood in complexity terms cannot be conceived in terms of preparation for the future. Rather, it must be construed in terms of participation in the creation of possible futures" (Davis and Sumara, 2008, p. 43). It is our belief that the MOOC format allows massive participation leading to the creation of possible educational futures.

Research Methodology

The research methodology of this study is a research-based case study. The research-based design is the MobiMOOC. For the case study research, we collected data from the final survey completed by MobiMOOC participants at the end of the six-week course. The survey posed questions on participation, level of familiarity with mobile technology, profession, gender, and other demographics. These data were then used to evaluate the hypothesis that MOOCs and the innovative elements of mLearning and social media can add to a new educational equilibrium based on an analysis incorporating chaos theory, emergence, and complexity theory. We were participants and researchers in the MobiMOOC.

The Problem

"The beginning of the new millennium has been described variously as an Information Age, a Digital Age, or a Knowledge Society." (Moore and Kearsley, 2005, p. 288) No matter which label it is given, we agree with McNeely and Wolverton when they stated that "we are living through one of the recurring periods in world history when far-reaching changes in economics, culture, and technology raise basic questions about the production, preservation, and transmission of knowledge" (McNeely and Wolverton, 2008, p. 7). This shift also has a profound effect on the leading education model used in the Industrial Age that has served as the balanced pedagogical framework for the past century. While the educational model of the Industrial Age focused on the linear transmission of information and knowledge, educators of this era search for a system dynamic enough to complement the new realities of the Knowledge Age. Chaos theoreticians argue that the nonlinear characteristics of the human mind and social interaction render the Industrial Age paradigm of teaching ineffective and deeply flawed (Cafolla, 2008). But if the education provided in the Industrial Age system is flawed, then educational researchers have to develop one or several new educational system(s) that fit this Knowledge Age and take into account the emerging technologies and learning/teaching realities of today. One such example, the MOOC, is addressed here.

There are currently two major technologies that have great influence on contemporary educational discourse, social media and mobile technologies, both of which impact learning in a profound way. Since 2005 mobile devices, social media, and the related learning that is facilitated by these new technologies have grown exponentially. The design for learning with mobile technologies is still tentative and exploratory, as mentioned by Kukulska-Hulme and Traxler (2007). However, several characteristics of mobile learning have emerged, including the importance of networks.

This rise of new educational forms (both from a pedagogical and technical point of view) has resulted in a quest for new learning methodologies and frameworks (McAuley, et al., 2010). "As new systems arise, so do new possibilities and new laws that cannot be anticipated, even with the most intimate knowledge of the components or agents comprising the new system." (Davis and Sumara, 2010) If we look at the rise of social media and technology and the increased information production resulting from the read-write Web, we cannot help but turn to complexity theory for ways to develop new educational systems that incorporate this dimension. MobiMOOC brought together three innovations linked to the Knowledge Age: mobile technology, social media, and the MOOC as its learning and teaching format. We acknowledge that an investigation of a MobiMOOC will not result in a complete educational framework for this era, but it will reveal many of the factors that impact contemporary education. By analyzing the MobiMOOC's complexity and emerging behaviors, we hope to add valuable information to the quest for a new educational framework and equilibrium.

In the first part of this chapter, we will describe the MobiMOOC. In the second part, we will analyze the MobiMOOC and its components in relation to complexity theory while looking at activities that emerge from the course.

Background: The MobiMOOC

General Overview of the Course

The MobiMOOC (see http://mobimooc.wikispaces.com/) was organized by Ignatia de Waard, running from 2 April to 14 May 2011, and she remained present throughout the duration of the course both as one of the facilitators and the overall coordinator. The six-week course focused on mLearning and used the MOOC format to deliver course resources and interact with all the participants. The course was free to anyone interested in the topic of mLearning, placing it within the principles of open educational resources (OER), and after completion of the course the content was made available via open source content platforms.

The MobiMOOC lasted six weeks, and each week focused on a different aspect of mLearning. Each week, a different mLearning expert facilitated the course. To ensure that participants were all on the same level, the course started with an introduction week on mLearning (facilitated by Inge de Waard), followed by mLearning planning (Judy Brown), mLearning for development (Niall Winters), leading edge innovations in mLearning (David Metcalf), interaction between mLearning and a mobile-connected society (John Traxler), and mLearning in K-12 (Andy Black). All the facilitators were guides on the side, each putting forward as many learning actions and follow-ups as they wanted because each was voluntarily engaged in the course.

Some MobiMOOC Numbers

By 14 May 2011, at the end of the course, the following activity was observed:

- 556 participants had joined the Google group over the six weeks when the course was running; however, only a limited number of them actively posted ideas or comments to the group discussions. After taking out those MobiMOOC group members who did not post anything (potential lurkers) and those who only posted a welcome message, there were 74 active (contributing) members.
- 1,827 discussion threads were started.
- There were 1,123 tweets on Twitter with the #mobimooc hashtag (see Figure 7.1). This is particularly interesting as it demonstrates the highs and lows of activity for #mobimooc tweets, as well as SMS text messages, voice calls, and Web site submissions.

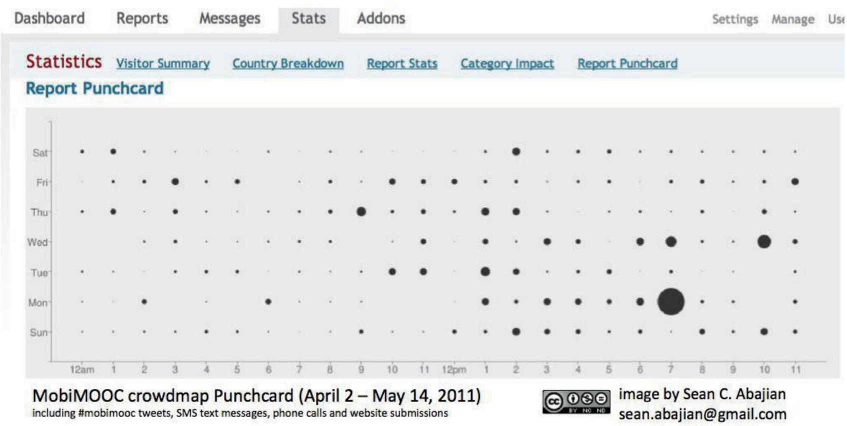

Figure 7.1 MobiMOOC Crowdmap Punchcard, Including #mobimooc Tweets

Clearly, the highest concentration of activity occurred during the weekly synchronous MobiMOOC presentations that happened on Monday. The class was given on Brussels, Belgium time (CET).

- 335 mLearning links were shared among the participants via the social bookmarking site Delicious.
- 32 participants completed the course as memorably active participants.
- 40 participants completed and submitted the final MobiMOOC survey from which we will draw conclusions.

After the course had ended there were 74 actively contributing participants (that is, individuals who wrote more than just the personal introduction comment). Forty participants completed and submitted the MobiMOOC survey (0.53%).

Taking into account the diversity of MobiMOOC interactions, one can see it or any MOOC as a complex system. In the next part of this chapter, we analyze the MobiMOOC as a complex system with its emerging phenomena and focus on dialogue forming the center of the class's meaning.

The MOOC as a Complex System

Organic pedagogical models correspond to and embrace vital conditions of self-organization, including fluid realm, openness to the information flow, turbulences and changes, freedom within flexible boundaries, richness of possibilities, interconnectedness of all parts of the system, and collective emergence (Laroche, et al., 2007, p. 74).

We believe these vital conditions of self-organization—openness of information flow, freedom, interconnectedness, and collective emergence—can all be found in MOOCs. In this section of this chapter, we look at a MOOC as a complex system embracing these vital conditions, using the data of the MobiMOOC as an example.

If a system is out of balance—in this case, the overall educational framework—numerous factors are influencing it in order to establish a new, sustainable equilibrium. Attaining a new balance is challenging, as chaos theory dictates that any seemingly small factor can have a major impact on the outcomes of the newly changed world. Hence the smallest change can affect, often negatively, the larger system. As such, it is important to analyze the characteristics of the MobiMOOC. By examining the characteristics of emerging educational formats, researchers can find a better direction to move in to obtain a new educational balance fitting the Knowledge Age.

A MOOC Is Self-Organizing

A MOOC can be defined as a complex system that, in order to survive and develop, is continuously in search of new ways to interpret the events of the external world. As a consequence of the feedback, it receives from the environment regarding its actions, the MOOC self-organizes, displaying emergent properties to interact with the environment in which it finds itself (Bertuglia, 2005). Reigeluth (2004) mentioned that systems require three characteristics: openness, self-reference, and freedom for people to make their own decisions about changes. He continued by stating that in order for a system to be open to its environment, it must actively seek information from its surroundings and make this knowledge widely available. This is exactly what happened in the MobiMOOC and what happens in MOOCs in general. The participants, by using open knowledge distribution repositories like the Web, share their experiences with others. These others can then give feedback to the MOOC, either positive or negative. This affects the learning system as it changes its structure to respond to the participants' dynamics. Such a reaction is interesting for in order for the system to adapt, it must be pushed out of balance first. This fits with what Laroche et al. wrote, "self-organization can occur in the realm of fluidity if the system is pushed out of equilibrium via some turbulence, gradients, or tension. The further the system is from equilibrium, the stronger the chance for self-organization" (Laroche, et al., 2009, p. 5).

An example of self-reference from the MobiMOOC is an interesting discussion that emerged on the issue of copyright. Some papers provided by instructors during the course were only accessible via paid library subscriptions. This resulted in a discussion about the belief that resources in a MOOC should be freely accessible to all. The freedom participants had to make their own decisions is illustrated by their ability to choose which tools they would use to disseminate or capture their thoughts about the course. This freedom and self-reference both reveal the MOOC as a self-organizing system.

A MOOC Is Connected and Open

Iannone (1995) wrote that using a chaos theory framework, today's curriculum should be flexible, open, disruptive, uncertain, and unpredictable, but it must also accept tension, anxiety, and problem-creating as the norm for the transformation process. The format of a MOOC is by definition open and online. In order to allow as many participants as possible to join the course, its resources are accessible via the Web. Laroche et al. (2007) added that "fluid environments have fuzzy and penetrable boundaries; they blur distinctions between schools, universities, nature and society, while juxtaposing formal and informal educational settings. Fluid environments are conducive to emerging non-orthodox forms of educational research" (Laroche, et al., 2009, p. 6). This fluidity can be placed within the connectivism theory from which MOOCs emerged. Additionally, this openness implies that a system should be willing to transform, indeed embrace the process as a natural product of openness and self-organization.

Connectivism and MOOCs

MobiMOOC was built on the concept of MOOC. Two separate individuals, Bryan Alexander and Dave Cormier, first mentioned the term MOOC. The concepts behind MOOCs were first introduced by Stephen Downes and George Siemens while they were developing a course format to fit with the theory of connectivism; this course came to be known as Connectivism and Connective Knowledge (CCK). “In connectivism, the starting point for learning occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a learning community.” (Kop and Hill, 2008, p. 2) Kop and Hill went further, stating, “connectivism stresses that two important skills that contribute to learning are the ability to seek out current information, and the ability to filter secondary and extraneous information.” (Kop and Hill, 2008, p. 2) This connectivism embraces complexity theory when referring to the organization of the course, which enables participants to connect outside of the learning environment and influence the course simultaneously. Mackness et al. (2010) found that when the theory of connectivism is used in the practice of a MOOC, its network principles of diversity, autonomy, openness, and emergent knowledge are included, giving it the characteristics of a complex system.

Transformation of the MOOC System

> To stay viable, open systems maintain a state of non-equilibrium ... they participate in an open exchange with their world, using what is there for their own growth... that disequilibrium is the necessary condition for a system’s growth. (Wheatley, 1999, pp. 78-79)

This constant flux is an inherent part of a MOOC. Nevertheless, even in this supposed chaos we can find stability in the seemingly strange attractors that occur.

According to Wheatley, transformation is strongly influenced by “strange attractors, which are self-portraits drawn by a chaotic system” (Wheatley, 1999, p. 123). Reigeluth mentioned that “fractals are patterns that recur at all levels of a system, called self-similarity” and added some examples:

> ...the autocratic control of education which appears in universities across the globe, the uniformity with which courses are formed in colleges and universities. Top-down control and uniformity are but two of many fractals that characterize our factory model of

schools. (Reigeluth, 2004, p. 8)

Strange attractors started to emerge in the new educational reality as well. Reigeluth mentioned that "one example of a strange attractor in education is empowerment/ownership, which entails providing both the freedom to make decisions and support for making and acting on those decisions" (Reigeluth, 2004, p. 8). He added that "these core ideas stand in stark contrast to those that characterize the industrial-age mindset about the 'real school': centralization and bureaucracy, standardization (or uniformity), and autocratic management". We saw learners empower themselves and take ownership during the MobiMOOC not only by applying principles of self-organization but also because they were able to build their own mLearning project, giving rise to emerging knowledge and personalized learning. MobiMOOC participants indicated that they did indeed make use of what they learned in the course, pointing to the fact that knowledge acquired was directly applicable and beneficial to the advancement of their education in the mLearning field (see Figure 7.2).

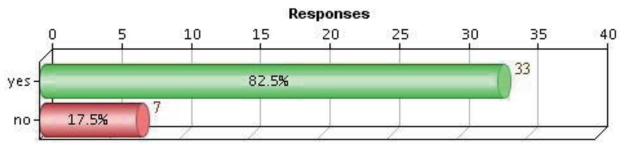

Figure 7.2 Have you been able to apply concepts or ideas that you encountered during the MobiMOOC in your own professional or personal context? (*N* = 40)

MobiMOOC also offered the participants the opportunity to develop their own educational project. In the final survey, many participants indicated that they worked on a personal project as well (see Figure 7.3).

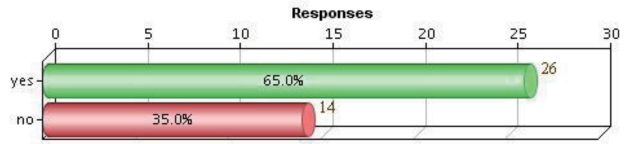

Figure 7.3 Did you work on a personal research-based mLearning project during the MobiMOOC? (*N* = 40)

A second example Reigeluth (2004) mentioned is customization/ diversification. This is ubiquitous on the Web, with people diversifying their reading and writing and their use of social media. Although that use seems to be very diverse, there are similarities in the use of social media for affordances are starting to become clear, such as perpetual connectivity, asynchronous interaction, unforeseen collaboration, and emerging learning opportunities. These social media affordances are already being embedded in MOOCs; for example, course syllabi are often offered to MOOC participants in the form of a course wiki, which was the case with the MobiMOOC as well.

In this section, we established the MobiMOOC as an example of an open and adaptive, complex system. This is important in the Knowledge Age because a wide variety of factors influence the learning/teaching process. If education is redesigned in order to suit the Knowledge Age, these self-organizing and open characteristics will be crucial.

Due to the openness of MOOCs and their ability to transform depending on the needs of the course or curriculum environment, we see new phenomena emerge which we will describe in the next section of this chapter.

Emerging Phenomena in MOOCs

Emerging Actions

Minsk (1986) stated that very few of our actions and decisions depend on any single mechanism. Instead, they emerge from conflicts and negotiations among societies or processes that constantly challenge one another. "Interactions of many sub-components or agents, whose actions are in turn enabled and constrained by similarly dynamic contexts, result in emergent phenomena." (Davis and Sumara, 2008, p. 34)Davis and Sumara (2008) have investigated the conditions that must be in place to allow these possibilities to emerge. They mentioned four important conditions linked to the MobiMOOC:

- internal diversity;
- internal redundancy;
- neighbor interactions;
- decentralized control.

Internal Diversity

Although diversity is an important factor, its impact cannot be foreseen. As Davis and Sumara wrote, "One cannot specify in advance what sorts of variation will be necessary for appropriately intelligent action, hence the need to ensure and maintain diversity in the current system." (Davis and Sumara, 2008, p. 39) Davis and Sumara saw this diversity as an enhancer for fruitful discussions and successful knowledge creation, stating that an "intelligent response to the same circumstances might arise among the interactions of a network" (Davis and Sumara, 2008, p. 39). In the case of our research, the diversity of the MobiMOOC resulted in new insights that we shared. MobiMOOC participants also showed diversity in both age (see Figure 7.4) and gender (see Figure 7.5), possibly indicating that the format attracts people from groups that typically don't interact.

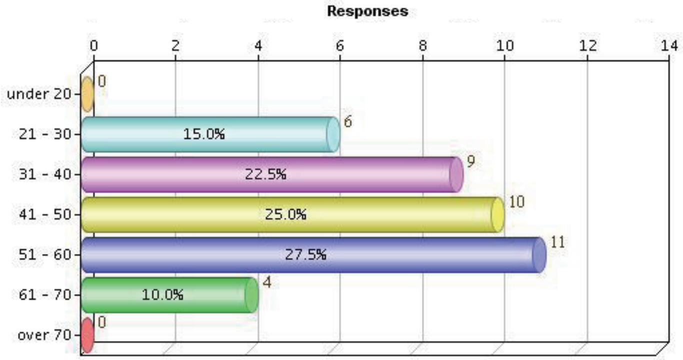

Figure 7.4 What is your age group? (*N* = 40)

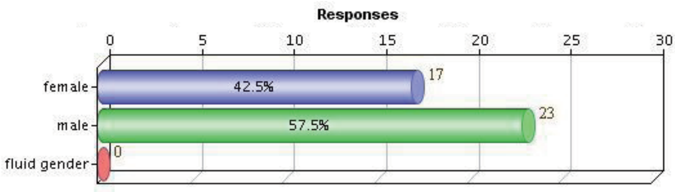

Figure 7.5 What is your gender? (*N* = 40)

We saw diversity in the dispersion of the MobiMOOC participants across the globe as well. Figure 7.6 illustrates visits to the MobiMOOC crowdmap: for the MobiMOOC crowdmap, there were 1,424 page views, 468 visits, and 372 unique visitors from 29 countries.

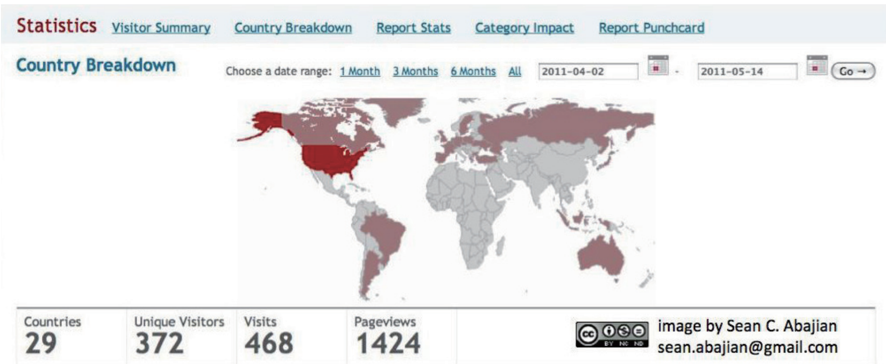

Figure 7.6 Overview of People Accessing the Social Media Tool MobiMOOC from Countries Around the World

In the final survey, it became clear that although MobiMOOC participants had a wide diversity of backgrounds (health professionals, K-12 teachers, corporate training managers, language teachers, etc.) most learned from mLearning concepts and insights from participants in other fields of expertise (see Figure 7.7).

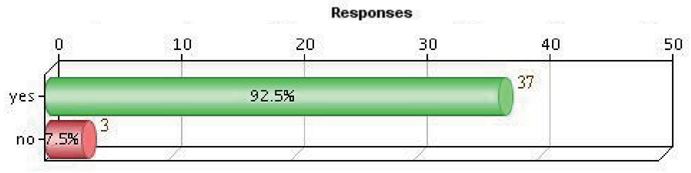

Figure 7.7 Did you discover new interests or new ideas from people in other areas of expertise than yours? (*N* = 40)

Internal Redundancy

The complement of internal diversity is internal redundancy, which refers to "duplications and excesses of those aspects that are necessary for complex co-activity" (Davis and Sumara, 2008). In the MobiMOOC internal redundancy included, among other factors, a common language (although not everyone was a native English speaker, English was understood and used by all), a common interest in one specific educational technology (mLearning), the willingness to share ideas, and a certain digital literacy that enabled participants to follow the online course. This redundancy permits complex coactivity by fostering diversity.

Davis and Sumara stated that "among humans, there is vastly more redundancy than diversity", adding that "redundancy enables interactions among agents" (Davis and Sumara, 2008, p. 39). Agents must be able to affect one another's activities in order to activate the internal dynamics of a collective learning system, hence our look at neighbor interactions.

Neighbor Interactions

When Davis and Sumara mentioned neighbor interactions, they specified that "the neighbors that must interact with one another are ideas, hunches, queries, and other manners of representation" (Davis and Sumara, 2008, p. 40), in the hope that these interactions will trigger other insights. They also said "the critical point is that mechanisms be in place to ensure that ideas will stumble across one another" (Davis and Sumara, 2008, p. 41). MOOCs support free interaction among participants, establishing a critical point of idea interaction and a place for the creation of knowledge.

Even though knowledge can be seen as residing in both humans and non-human appliances, it is what we do with that knowledge, and how we construct new knowledge, that is important. This is where a Vygotskian perspective is quite useful. According to Vygotsky (Nassaji and Swain, 2000), knowledge is social in nature and constructed through a process of collaboration, interaction, and communication among learners in social settings. We saw this happen in the MobiMOOC repeatedly. Through a process of collective scaffolding (Donato, 1994) some participants assisted others to expand their understanding of mLearning and in some cases also helped them implement their own mLearning projects. In many cases, participants received constructive feedback from their classmates on projects that they were either implementing or designing. This collective scaffolding enabled participants to work within the zone of proximal development (ZPD) (Vygotsky, 1978) and to expand their capabilities with the help of more knowledgeable peers. MobiMOOC ascribed to the Vygotsky principles of collaboration, interaction, and communication, revealed most clearly in the assistance participants offered to one another throughout the course.

Decentralized Control

Although there was a centralized coordinator and each MobiMOOC week was facilitated by a different mLearning expert, the participants had control over part of the advancement of the course. The MobiMOOC participants could, for instance, put forward discussion topics that were then taken up by others. "One of the properties of complex systems is that they allow emergence of smaller complex systems within them." (Laroche, et al., 2009) This happened as a result of decentralized authority and the fact that the participants were in control of their own learning. The dynamics of the MobiMOOC resulted in smaller complex subsystems that arose. This chapter, for example, is a result of MobiMOOC participants who volunteered to join and engage in an emerging, unplanned action. Such an act is related to what Jenkins et al. (as cited in Davis and Sumara, 2008) described as educational research based on complexity, for it must be interpreted as participatory—meaning that there are opportunities for expression and engagement, there is support for creating and sharing creations, there is some type of teaching so the most experienced can mentor new members, members believe their contributions matter, and members feel social connection with one another (p. 43). Other emerging connections also occurred and resulted in participants setting up new collaborative projects, shown in Figure 7.8.

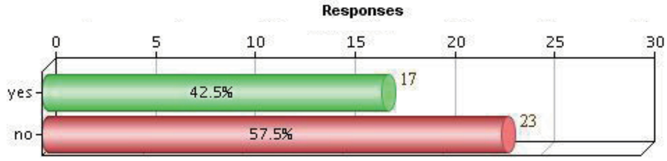

Figure 7.8 Have you connected to any other MobiMOOC participants in order to collaborate on projects after the MobiMOOC? (*N* = 40)

Emerging Technologies

"Transformation occurs through a process called 'emergence', by which new processes and structures emerge to replace old ones in a system." (Reigeluth, 2004) When looking at the read-write Web, we can see that knowledge creation happens in different ways now than it did during the Industrial Age. The possibility for individuals to create knowledge and share it online replaces the old classroom exchange where the teacher knows and transmits, and the learner in turn absorbs. Looking at phenomena emerging from technologies can point us in the direction of a renewed educational equilibrium. The MobiMOOC offers the chance to look at two emerging technologies, mobile technology and social media technology, that have a major impact on the learning/teaching process.

MLearning in MobiMOOC

"MLearning has attracted a great deal of attention from researchers in different disciplines who have realized the potential to apply mobile technologies to enhance learning." (Özdamar and Metcalf, 2011, p. 1) This focus on mobile technology-driven learning is only just emerging. "Early definitions of mobile learning were too technocentric and imprecise...they merely put mobile learning somewhere on e-learning's spectrum of portability", remarked Traxler (2009, p. 3), which sells mLearning short. Laurillard made a strong point when she mentioned that "the point of turning to new technologies is to find the pedagogies that promote higher quality learning of a more durable kind than traditional methods" (Laurillard, 2007, p. 158). This "more durable" brand of learning is what we explored with the combination of the MOOC format and the pedagogy of mLearning.

Participants used mobile devices during the MobiMOOC. Although they did not always have to access materials via mobile devices, many did use them to interact with course materials (see Figure 7.9). In the final survey of the MobiMOOC, participants indicated the reasons they preferred to use mobile devices to access course materials (see Figure 7.10). The predominant reason participants gave for using a mobile device was the location independence it afforded. Participants were not tied to a desk in order to take part in class, rather they could contribute wherever they were. Closely tied to the location independence was the temporal independence. Participants were able to access materials at both a time and place convenient for them. Another reason why participants used mobile technologies to access the course was simply because they were there, and people exercised their ability.

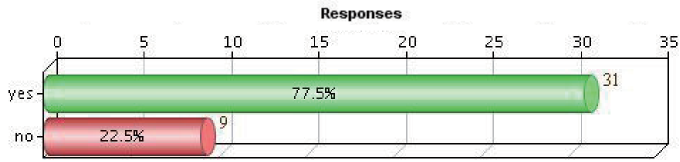

Figure 7.9 Did you use a mobile device to access MobiMOOC course materials? (*N* = 40)

Result	Responses	Percentage	Graph
time flexibility (no matter when)	25	56.8%	
location flexibility (no matter where)	27	61.3%	
the information was accessible through a mobile device	13	29.5%	
other	6	13.6%	

Figure 7.10 If so, what was the reason to access the material with a mobile device (please check all that apply)? (*N* = 40)

MLearning first emerged as a strong technology-driven field but quickly garnered the interest of educational researchers for mobile devices and their use had an impact on knowledge creation. The fact that mLearning allows learners to access information and share knowledge no matter what time or place makes it a useful new addition to the learning/teaching process. Additionally, mLearning enables the learner to embed their own context, thus personalizing the learning path. Interestingly, some of these mLearning characteristics can be found in social media technology as well.

Social Media Tools

Social media has opened up spaces for learning. Learning discussions used to be confined to traditional classrooms or study groups within the physical university campus. Even in online courses, discussions were segregated behind the walls of the virtual classroom, but this is now changing rapidly. This shift in learning spaces puts pressure on the older, more limited learning spaces from the Industrial Age.

The use of social media is central to a MOOC as it allows the critical aspects of connectivity, communication, and interaction. Connectivity is important due to connectivism (from the theory perspective) and because MOOCs are online (the practical aspect). Communication and interaction are a part of connectivism and constructivism since learners can't co-create knowledge if they can't communicate and interact. As such, we designed the MobiMOOC to include a variety of web-based tools. The coordinator chose to centralize the course around two web-based spaces: a MobiMOOC Google group and Wikispace. Both also had an RSS feed to keep participants informed about the latest inputs. The coordinator set up the Google group to centralize discussions, while the course wiki functioned as an online syllabus. Participants used other social media spaces, such as YouTube, Twitter, Facebook, and Delicious throughout the course for sharing specific content. In addition to the official MobiMOOC web spaces, some of the participants added other spaces during the MobiMOOC as well. Examples of these are the MobiMOOC Crowdmap, a MobiMOOC LinkedIn group, MobiMOOC Posterous blogs, the Zotero MobiMOOC group, and a MobiMOOC map based on Google maps. All of these web applications underline the complexity inherent in a MOOC that gives rise to emerging subsystems.

Bringing mLearning and Social Media Together

Due to the pervasiveness of mobile devices in society, connecting to a community across space and time is becoming more relevant.

> Mobile phones have created "simultaneity of place", a physical space and a virtual space of conversational interaction, and an extension of physical space, through the creation and juxtaposition of a mobile "social space". This affects people's sense of time, space, place, and location, their affiliations and loyalties to groups and communities, the ways in which they relate to other individuals and to groups, their sense of their identity, and their ethics. (Traxler, 2010, p. 2)

But the same can be said of social media, or the rise of ubiquitous learning. Due to the use of social media, people, and learners in particular, can surpass time and space. As Siemens wrote, learning is now happening "through communities of practice, personal networks, and through completion of work-related tasks" in an environment in which "know-how and know-what is being supplemented with know-where (the understanding of where to find knowledge needed)" (Siemens, 2005, p. 4).

This is the first time in history that learning content can be accessed via mobile devices and social media. These tools expand knowledge acquisition beyond traditional classrooms and libraries, redefining those spaces and adding to knowledge spaces overall. When describing mLearning, Winters (2007) listed three interesting aspects: mLearing enables knowledge-building by learners in different contexts, it enables learners to construct understandings, and the context is about more than time and space. Indeed, the same can be said about learning through a MOOC. A MOOC surpasses time and space as all the class resources are centralized in the cloud, accessible for those who are willing and technologically able (that is, those who have the right devices, sufficient training, and physical/mental ability). Similar to mLearning, a MOOC fits the learners' context(s) and enables knowledge construction. Like Bell (2011) said, "knowledge can be viewed as residing in networks of humans and non-human appliances, whilst leaving space for human agency."

In this part of the chapter, we have shown that a MobiMOOC includes both new learning actions and the integration of emerging technologies. This openness to stimulating emerging phenomena and incorporating them into its structure is essential in a Knowledge Age where technological development and peer knowledge creation is at the center of the new educational environment.

Dialogues at the Center of Meaning

The successful development of online communities also requires "common goals or interests, repeated participation, discussions and feedback, multiplicity of possibilities, flexible thinking structures, interpersonal connectivity, collaboration, interactions, distributed leadership, assigned roles, and shared outcomes" (Abel, 2005; Farrior, 2005; Kelland, 2006; Kim, 2001 as cited in Laroche, et al., 2007). If we analyze these requirements—discussions, feedback, collaborations, etc.—it becomes clear that conversations between people are at the center of those online communities. This exchange of ideas that goes back and forth between members of a community is essential, because "more than any other way, people learn not from courses or Web sites but from each other ... through dialogue" (Rosenberg, 2006, p. 158). Dialogue has always been integral to human communication and growth.

"The rapid development of technology and exponential growth in the use of the Internet, along with the Web 2.0 and mobile developments, make new and different educational structures, organizations, and settings a possibility." (Kop and Hill, 2008, p. 9) But due to all these societal changes, the dynamics between people are growing more complex as well. As the Knowledge Age becomes more of a reality, that complexity reaches the field of learning and education and trickles down to MOOCs. Communication, dialogue, and living through experiences in a collaborative way are central to the idea of a MOOC. Since one of the central content spaces in the MobiMOOC was a Google group which promoted discussions, the coordinators incorporated dialogue in the core of the course.

Traxler's belief that "mobile technologies are redefining models of learning that often rest on a Socratic or dialogic base" (Traxler, 2010, p. 13) adds to Sharples' (2005) idea that learning is a conversation in context. This emphasis on dialogue and conversations is also mentioned by Siemens, who wrote that learning and knowledge "rest in diversity of opinions" [Siemens, 2008, para. 8, as cited in (Kop and Hill, 2008)]. Diversity, as previously established, is a core component of the MobiMOOC experience.

Cultural theorists (Vygotsky, 1978; Derrida, 1976; Bakhtin, 1981) have suggested that all of our understandings are situated in and emerge with complex webs of experience, so we can never discern the direct causes of any particular action. Learning is also strongly contextualized. Davis and Sumara mentioned "as the learner learns, the context changes, simply because one of its components changes". As such, they conclude that "any teaching/learning situations are intricately, ecologically, and complexly related" (Davis and Sumara, 1997, p. 414).

As a MOOC is a gathering of people with almost no prior connection, it has a unique social edge which relates to a more open and connected way of thinking and conversing. This coincides with what Downes (2007) wrote, that the "activities we undertake when we conduct practices in order to learn are more like growing or developing ourselves and our society in certain (connected) ways".

Dialogue is also at the center of constructing knowledge since "dialogue is the primary mechanism for maintaining connections and developing knowledge through them" (Ravenscroft, 2011). While a MOOC is an ideal place for dialogue to take place and, as such, for knowledge to be constructed or appear, the same is true for mLearning, as with mobile devices the learning environment is enhanced and the ability to share knowledge through online discussion is strengthened through social media. The sharing of experiences in a network facilitates the transformation of learning outcomes into permanent and valuable knowledge assets (de Waard and Kiyan, 2010, p. 5).

Learning is not a linear process; it is a continued iteration which links to prior knowledge. That knowledge can then be modified after evaluating the new information and integrating it. As such, learning and knowledge are in a constant state of flux. This fluctuating state of knowledge is even more emphasized in informal learning for the learner is taking his or her own interpretation and testing it against the ideas of other participants. In the MobiMOOC, this sharing of new ideas was clearly not limited to the course participants. Participants took the new information and ideas out of the course and tested it in other learning networks as well. This multiplication effect is shown in Figure 7.11.

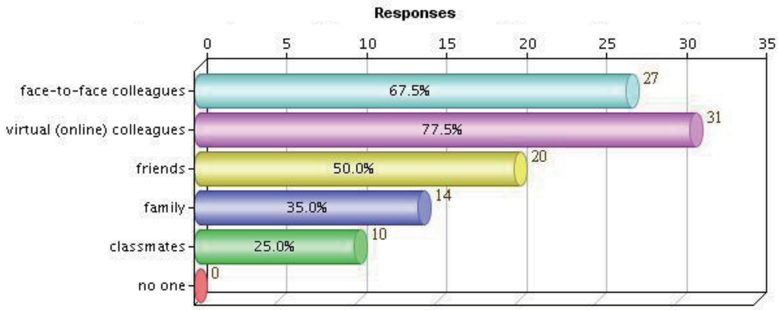

Figure 7.11 With whom outside of the MobiMOOC did you share what you have learned in the MobiMOOC? (*N* = 40)

And when we asked participants how they shared information, again they listed a mix of face-to-face, mobile phone, and social media dialogues (see Figure 7.12), once more pointing to dialogue as a core feature of learning in any world, whether face-to-face or digital.

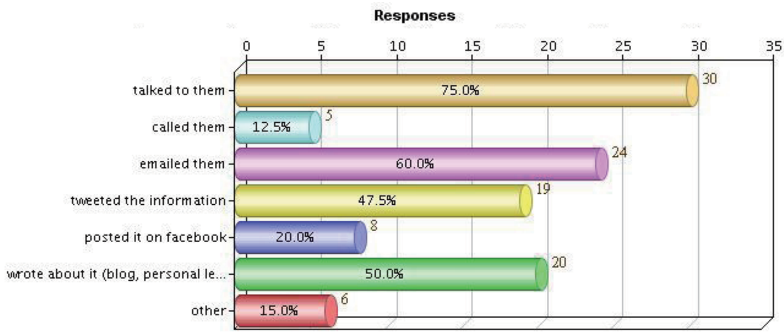

Figure 7.12 If you shared information with others, how did you share it? (*N* = 40)

Our understanding that dialogue is a human aspect of both communication and learning results from the belief that the MOOC format could also benefit other learning communities due to its very open nature of constructing new knowledge and its very human characteristic of connecting to peers. This belief was strengthened by the result from the final survey shown in Figure 7.13.

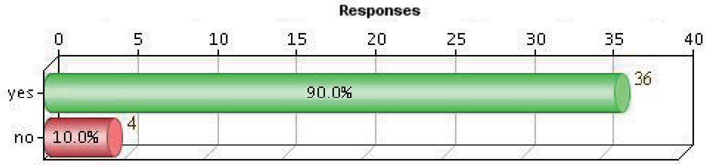

Figure 7.13 Do you think the MOOC format is appropriate for your learning communities? (*N* = 40)

Based on our findings in this study, we can see that dialogue has always been at the center of knowledge exchange. However, it has never before been possible to include large parts of society in the conversation. Patterns of meaning can be formed across regions and institutions if a network of connected people comes together. If educators want to form a new educational framework, it needs to be stimulated by dialogue emerging in virtual, online spaces. The MOOC format enhances dialogue, and, as such, it strengthens educational combinations of contemporary technology and pedagogy.

Further Research

Chaos theory in education is still in its infancy when we take into account the new technologies and formats that are rising in this Knowledge Age. Devices and programs continue to change, so there is considerable uncertainty about what will be the best new educational framework for the Knowledge Age, and attempts to address this question form an interesting research strand.

MLearning and MOOCs consist of a variety of factors, and each might influence the success of a MOOC as a new educational format. More research should be undertaken into the realities, benefits, and challenges of MOOCs and mLearning in order to map all of their contributing dynamics.

Further research is needed to determine whether MOOCs are attracting a specific learner profile not linked to age, gender, or cultural background, but rather to intrinsic and extrinsic motivations.

We found the retention rate of the MobiMOOC interesting as after the course closed, the network between the participants remained active, indicating that they feel the MobiMOOC community is more useful than we previously anticipated.

There is also a need to determine design principles for MOOCs to effectively maximize their self-organizing, self-referencing, and knowledge-producing capabilities. We believe it would also be helpful to see the ethnic and socioeconomic breakdown of participants in a MOOC to determine whether this format is actively promoting participation from any particular demographic. Finally, the affordances of mLearning and social media need to be investigated in order to use them in the new educational environment.

Conclusion

Reigeluth (2004) already pointed educational researchers in the right direction when he wrote that chaos theory and the science of complexity can help us to understand and improve the process in which educational systems engage to transform themselves. When looking at the shift in learning which is happening as a result of the rise in social media, ubiquitous cloud computing, and new technologies, a MOOC complements all these changes, and mLearning offers the devices and characteristics to realize them.

The MobiMOOC we ran was an example of an open and adaptive, complex system. The technologies that we used gave rise to emerging phenomena in its activities. Additionally, dialogues were central to knowledge creation within the MobiMOOC. This combination of factors that characterize MOOCs which use new technologies makes them a possible solution in the search for new educational environments that fit this Knowledge Age. Education is changing under the influence of a wide variety of factors, and there is a need to further investigate all of them so that the research community can come up with a redesigned framework in which emerging technologies enrich educational institutes, tools, and formats.

In this chapter, we have embedded MobiMOOC and MOOCs in a framework of chaos theory, complexity, and emergence.

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8

Changing the Way of Learning: Mobile Learning in China

Li Shiliang Sun Hongtao

Abstract

The study explores the current state of mobile learning in China. From a literature review and the analysis of an official Internet report, this chapter presents the overall state of mobile learning research in China. An online survey and follow-up interviews were conducted to collect quantitative and qualitative data of mobile learning. Result shows that mobile terminals have surpassed the desktop computer and become the most important way to use the Internet. Although there are organizations that started mobile learning 10 years ago, generally, mobile learning is still in a beginning stage in China. Mobile devices, such as smart phones, laptops and tablets, are becoming popular in China. Regional difference is still obvious. But devices will not be an obstacle to mobile learning in the near future. Portability, screen size, and the battery are the most considered characteristics of mobile devices. Students are the largest groups that are using mobile learning. Multimedia materials and e-books are the most accepted contents of mobile learning. Social networking applications are frequently used. Limited connectivity and bandwidth are regarded as the biggest barriers to conducting learning activity through mobile devices. Lack of mobile learning knowledge is also reported as a common problem of students. Chinese researchers understand the importance and characteristics of mobile learning. Some of them have established a theoretical framework of mobile learning. However, mobile learning practice is not enough. Most of the mobile learning projects are from universities and educational administrative departments. Pedagogically related design issues will become one of the hot areas of mobile learning research in China.

Introduction

Up to the end of June 2012, Chinese Internet users reached 538 million. Internet penetration is 39.9%. In the first half of 2012, the increment of Internet users was 24.5 million, and penetration increased by 1.6%. Up to the end of June 2012, China's mobile phone users had increased to 388 million (CNNIC, 2012). In all of the Internet users, the on-the-job group (41%) was the largest one. Students (28.6%) ranked No.2. Considering that the on-the-job group included various kinds of people, which were freelancers (17.2%), professional and technical personnel (9.5%), enterprise staff (8.7%), government organs staff (4.4%) and so on, the students group was the real largest user group(see Figure 8.1).

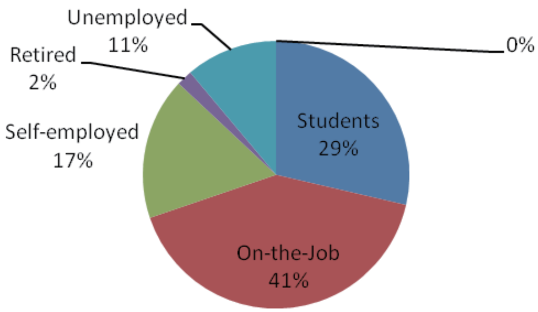

Figure 8.1 Occupations of Internet Users

Internet users who are using desktop computers were 70.7%; compared to the second half of 2011, it dropped by 2.7%. The Internet phone ratio increased to 72.2%, more than desktop computer use (see Figure 8.2). The way of Chinese Internet users accessing the Internet presented a new pattern. In the first half of 2012, the users that accessed to the Internet through the mobile phone reached 388 million, surpassing desktop computer users which were 380 million. The mobile phone became the biggest Internet terminal in China. Recently, smart mobile phones became more and more popular in China because of their powerful function and relatively cheap price. Multimedia functions are the most popular function of smart phones. Nowadays, more than one hundred million (27.7%) mobile phone users use the mobile phone to watch video.

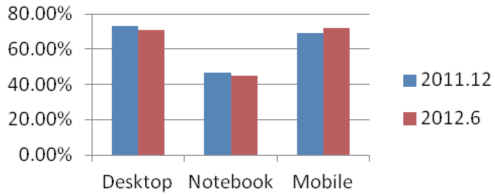

Figure 8.2 Percentage of Internet Devices

In the first half of 2012, Chinese Internet users' average weekly online time increased to 19.9 hours from 18.7 hours in 2011. In the meanwhile, they effectively used the fragments of time through the mobile devices. The mobile device enhanced Internet usage. With the rapid development of the smart phone, it's more and more popular to use mobile device to surf the Internet.

The instant communication tools of smart phones designed for video calls show greater competitive advantage, and attract more and more users. In addition, some of the most popular applications of the smart mobile in China, including instance message tools and micro-blog tools, gradually transform from simple function tools to open platforms. More and more third party applications could be developed using these platforms. Among all the third party applications, social networking apps are the most popular ones.

Communication applications and information acquisition applications are still the mainstream of mobile phone applications. Besides, video related applications develop very fast. Watching video with a mobile phone is very common among users. As for educational resources, open courses are becoming the most influential ones. NetEase, one of the biggest IT companies in China, hosts a website for open classes which include courses from MIT, Harvard, TED, and Khan Academy. The use of micro-blogs and search engines is increasing in a fast way. Along with the mobile terminal intelligent trend, the future of mobile phone applications will focus on voice-input and location-based systems.

Mobile Learning Research in China

Mobile learning research in recent years has been transformed from e-Learning to m-Learning and then to u-Learning. Related research ranges from the theory to the resource, from the terminal to the platform, from the activity to the practice (Fang et al., 2011). Mobile learning researchers are mainly from colleges and research institutions. Besides colleges, other social forces pay less attention to mobile learning, such as company employees, primary and secondary school teachers. Practice issues are not studied enough in mobile learning.

The development of mobile communication technology provides a technological foundation for mobile learning. Nowadays, people are eager to gain more information and resources with the convenience of a mobile phone. In a learning society, people want to learn more quickly and more independently (Qiu, 2008). Learning can happen at anytime and anywhere through mobile devices and wireless networks. Mobile learning activities include resources accessing, collaboration with others, and personal and social knowledge construction (Yu, 2007). Li and Zheng (2009) define ubiquitous learning as anyone, anywhere, anytime, using readily available learning devices (any device); people need to learn information (any contents) to get learning support (any learning support) in their own way (in anyway). Generally, researchers understand the importance and characteristics of mobile learning. Some of them have established theoretical framework of mobile learning.

Review of Mobile Learning Projects in China

Mobile learning projects in China are mainly in higher education, life-long education, distance education and vocational training. There is some experimental research to provide personalized services to support college students' use of mobile devices as management and learning tools. In life-long education, mobile learning focuses on learning resources that meet the challenge of different age groups and different actual needs from the adult learners. Distance education tries to provide a full range of mobile learning environments and learning support systems. Vocational training focuses on promoting work-based mobile learning to solve problems encountered in practical work.

The Modern Education Center of Beijing University conducted a pilot project of the Department of Higher Education, named mobile educational theory and practice, which run from January 2002 to December 2005. This project developed a mobile education platform based on the GSM network and GPRS-based mobile devices. The project also developed a semantic network platform based on ontology, as well as an educational resources publishing platform. After that, Beijing University, Tsinghua University and Beijing Normal University started a mobile education project for the Ministry of Education. This project established a mobile education information network and mobile education service station system. In March 2006, the Institute of Educational Technology of Beijing Normal University launched a project on handheld network learning systems. Some of the research findings had been put to practical use. There are also several studies from middle schools, like the mobile learning study in primary and secondary school which indicates that extending the classroom learning to the outdoor would enhance the classroom teachers and students' effective communication.

Wang (2012) designed a mobile learning system model based on location service. Different mobile operating systems have different opening degree and development ideas. Open content and open source will be the development trend of future intelligent mobile phone operating systems. A healthy ecological environment, like Apple iOS and Android, is critical to a mobile system. According to the mobile learning system's target orientation, function module, and application process, there are different choices of appropriate mobile learning application modes, such as the situation mode, game mode and virtual reality mode, etc.

The Ministry of Education released the "Education Informatization Ten Years Development Plan (2011-2020) " last year, and put forward the grand goal: "by 2020, complete the education informatization goal task proposed in the national education blueprint, form the education informatization system nationwide adapted to the national education modernization development goals, basically complete the information learning environment that everyone can enjoy high-quality education resources, form the informatization support service system of the learning society". The Ministry of Education initiated a "China Digital Education 2020 Plan", hoping that through 10 years of hard work, ICT education reform would move from the preliminary application integration development stage to the comprehensive integration innovation stage.

Methodology

The research on the state of mobile learning in China has important practical implications. This study aimed to explore the current state of mobile learning in China. In the study, mobile learning is defined as any learning or training (i.e., knowledge construction, skill development training and performance support) which learners engage in across various locations and contexts at the time of their choosing. Such learner-centered learning is afforded by portable devices providing flexible on-demand access to learning materials, experts, peers and other resources from any location.

Convenience and purposive sampling were used in order to access mobile learners and adhere to project deadlines. Through literature review, we found that the present Chinese Internet users were in the following groups: students, employees, and government departments. These people are potential users of mobile learning. So we decided to choose these types representative of the sub-groups from all Internet users. Then we selected random samplings within the subgroups.

The questionnaire was adapted from a similar study conducted in Canada by Athabasca University. The questionnaire was translated into Chinese and back translated by other Chinese speakers to ensure meaning was comparable. The questionnaire was completed online via the lime-survey service of the Research Center for Distance Education of Beijing Normal University. The questionnaire contains 36 questions, mainly related to the background information, the usage of mobile learning, and the research into mobile learning. After the online questionnaire, we chose 31 volunteers who said they would like to accept our interview to get deeper understanding of mobile learning and training in their organizations.

Procedure

Data collection

Quantitative and qualitative data were collected from a survey and a questionnaire in this research.

According to the China Internet Network Information Center (CNNIC)'s findings of occupations of Internet Users (as shown in Figure 8.1), we chose 1,000 respondents, including students (*N*=300), office workers (*N*=400), and other Internet users (*N*=300). During the period May 2012 to November 2012, respondents were asked to complete the survey by linking to the online survey using their usual communication methods.

For student groups, we chose students from different universities and the Chinese Doctor Group of educational technology. The group was chosen from the QQ group, which is the most and only popular Instant Message (IM) tool in China. For working groups, we sent invitations through the micro-blog community in Weibo.com, which is the widest used Social Network Site (SNS) in the working people group. For other Internet users, we send invitations via email. The email addresses were obtained from contact e-mail on each company's website.

We set up an online survey site using the Lime Survey, which is an open source online survey tool. The Lime Survey allows users to quickly create intuitive, powerful, online question-and-answer surveys. It supports multiple question types, like arrays, mask questions, multiple choice questions, single questions and text questions. After the survey was set up in the Lime Survey, anyone who clicked the link could answer the questions anonymously.

Participants

A total of 172 participants completed the survey. To collect further information, a total of 31 semi-structured interviews were conducted after the online survey was completed. Feedback from interviewees is summarized in the results and discussion sections.

Respondents were from many regions of the country, but mainly from Beijing, Shanghai, Shenzhen, and Guangzhou. This result was consistent with Li Fan's study; that is, regional distribution is not balanced, being mainly in Beijing, Shanghai, Zhejiang, Liaoning, Guangdong and other regions. These regions were mobile learning research core areas, because these regions were economically developed areas, and had a group of academic institutions (Li & Chen, 2010).

As shown in Figure 8.3, respondents' industries were mainly distributed in Communication (1.75%), Services (4.68%), Retail (5.80%), Education (44.44%), Government (2.34%), and IT (5.85%). As shown in Figure 8.4, the ratio of respondent organization was distributed in small organizations (15.20%), medium size organizations (10.53%), and large organizations (33.92%). Some respondents (40.35%) refused to answer this question. In the subsequent e-mail contact, we found that this group of respondents were mainly students; they thought that they had no employer.

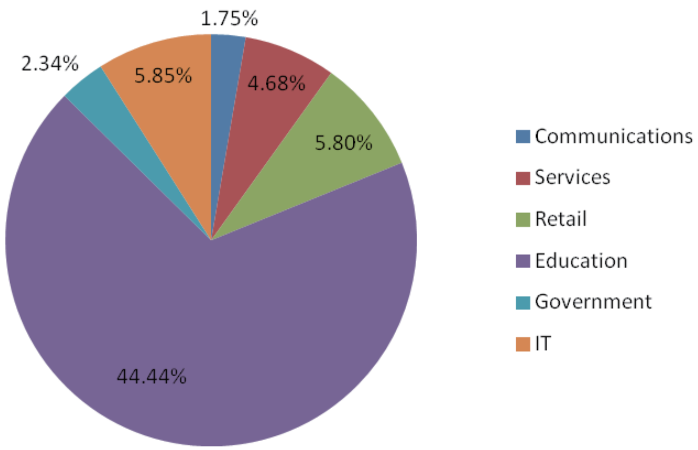

Figure 8.3 Industries of Respondents

Most of the respondents were students, teachers, IT managers and instructors. They were familiar with the concept of mobile learning. The reason some of the potential participants did not complete the questionnaire is that they said that they did not understand concepts such as just-in-time content, LMS, location-based learning, etc.

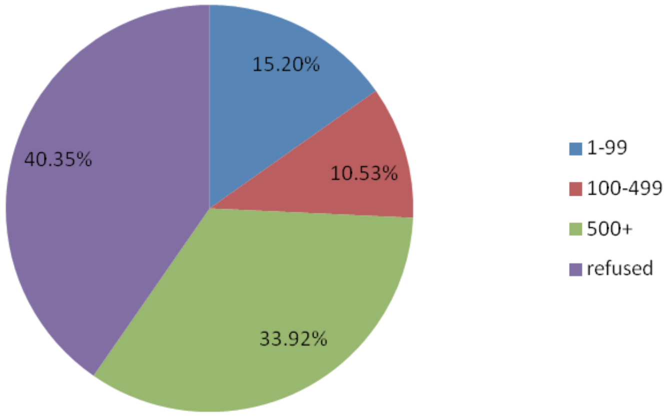

Figure 8.4 Employees

Data analysis

The quantitative data were obtained from Lime Survey software and analyzed with Excel. The quantitative responses were transformed to Excel charts. A description was also given to summarize the findings. The results are presented below. Two researchers analyzed the content of interviews independently to ensure inter-rater reliability.

Results and Discussion

Respondents mentioned that mobile learning in China is still in the beginning stage. Over half of the respondents believed people adopted an innovation after the average member of society and were typically skeptical about an innovation. Only 8.72% of the respondents thought that 75% of their learning was provided by mobile learning; over 60% of the respondents thought their mobile learning percentage was less than 10%.

The Mobile Device

Among all different kinds of devices, laptops and smart phones are the most frequently used types. The ratios of these two devices are both over 50%. Another 24.07% respondents are considering using smart phones and 22.91% are considering using laptops. But the mobile device that most respondents considered is the tablet (28.72%). Follow-up interviews show that when respondents choose a mobile device, several important issues are considered. Among them, the top three are portability, screen size, and battery life. Tablets fit their need in all three respects (see Figure 8.5).

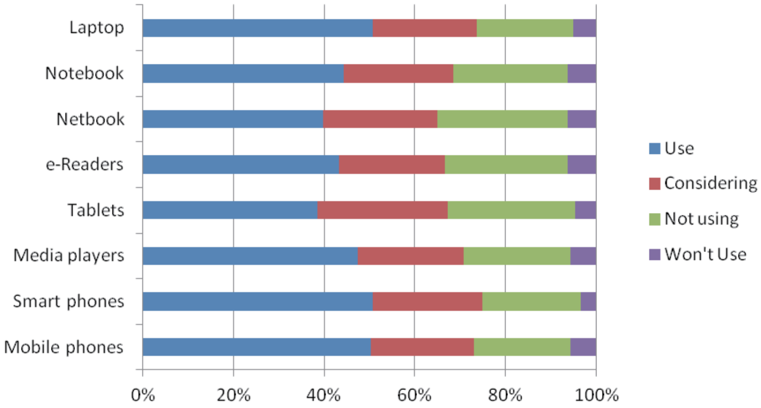

Figure 8.5 Mobile Devices

As for the definition of mobile device, most of the respondents hold that the mobile phone and the tablet are typical mobile devices. The laptop can be considered as a mobile device, but the battery endurance limits its mobility.

The Mobile Learning Activity

In all kinds of groups, students get the highest popularity in mobile learning. As shown in Figure 8.6, over 70% of the respondents believe students are the biggest mobile learning audience. Students like referential applications that use the mobile phone's ability to access multiple resources and keep social connection with each other. Mobile equipment is light, flexible and moveable. These advantages are more able to attract the eyes of college students, to make them accept the new mobile approach to learning (Wang et al., 2009). Students' preferences for mobile learning include contents and activities which represent the overall condition of mobile learning in China.

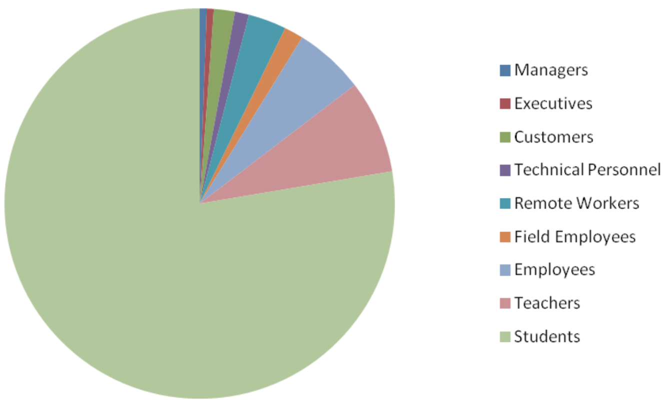

Figure 8.6 Mobile Learning Audiences

Audio/video and e-books were the most accepted contents of mobile learning, as shown in Figure 8.7; they were over 60% of implementing or implemented. As we mentioned in the literature review, top websites like Netease.com and Sina.com in China are hosting OERs, and also provide mobile applications to watch video. There is also another famous company in language training named New Oriental who provide a mobile English class service. The contents provided by this website are frequently used by students in China. Keeping social connection is another major function of mobile learning activity. 61% of respondents use social networking applications to connect with other people. Follow-up interviews showed that QQ and WEIBO were heavily used by students and young people. The popularity of location-based social network applications is increasing in a very fast way. Beyond social connection functions, respondents believe location aware applications have more advantages in mobile learning.

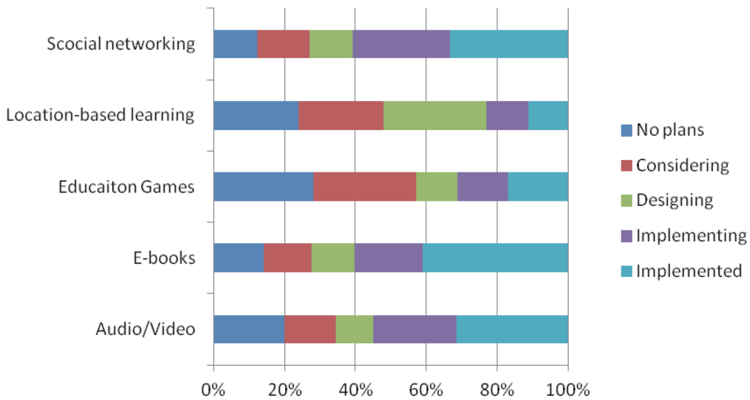

Figure 8.7 Contents of Mobile Learning

Users need location aware applications that contextualize information, allowing learners to interact directly with their environment. For example, collecting environmental data linked to geographical context or accessing contextually relevant reference material.

However, the usage of locate based functions in mobile learning is still in primary stage comparing to the understanding of the importance. As shown in Figure 8.7, over 50% of respondents were considering or designing location-based learning, but only 11.16% of respondents had implemented this type of learning.

The majority of respondents realized the characteristics of mobile learning. Over 41% of respondents have started to develop materials for mobile learning and 20% adapt original material to mobile learning. It's predictable that more and more contents for mobile learning can be used soon.

Benefits and Barriers

Mobile learning can support learners to study from anywhere and at anytime. The top benefits of mobile learning that respondents mentioned were: learning on the go (20.35%); just-in-time learning, at the time you need it most (17.44%); personalized learner-centered learning (17.44%); on-demand access to materials and other resources (16.86%); learning and performance support in a relevant real-world context (16.28%).

The top two barriers to mobile learning are limited connectivity and limited bandwidth, as shown in Figure 8.8. Learning may be chunked up and interrupted while in the subway or in some buildings. The bandwidth of China Mobile is about 30KBps, and the 3G network of China Telecom and China Unicom is about 200KBps. The former is the largest mobile group in China.

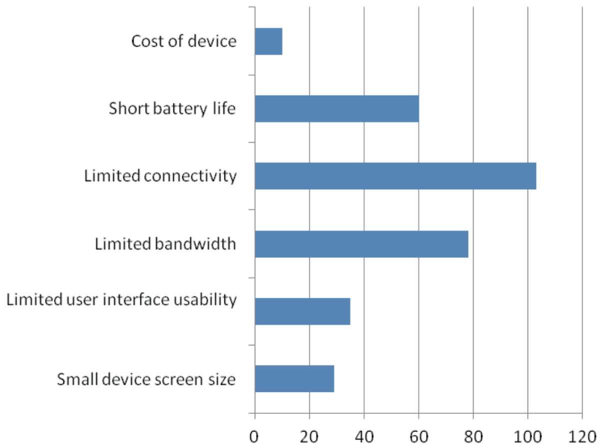

Figure 8.8 Barriers of Mobile Learning

The survey also shows that lack of knowledge of mobile learning becomes one of the biggest barriers to mobile learning.

Current Stage of Mobile Learning

Only 20% of organizations surveyed have carried out mobile learning for more than 3 years. Although 9.49% of organizations started mobile learning 10 years ago (see Figure 8.9), the follow-up interview showed that laptops were mainly used in their organizations. The form of their learning is more like traditional eLearning.

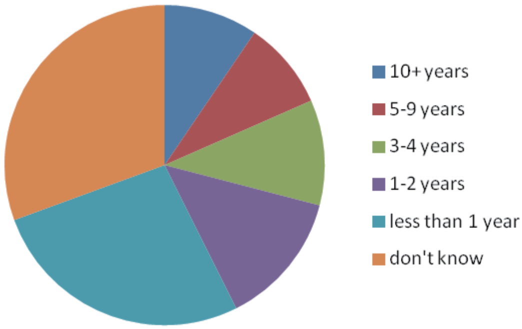

Figure 8.9 Duration of Mobile Learning

When asked how innovative their organization was with regard to implementing mobile learning, 27.44% of respondents said that their organization was among the early majority in adopting mobile learning and 17.56% of respondents believed their organizations were among the late majority. For China as a whole, 23.37% of respondents said they were an early majority and 23.95% respondents said they were a late majority. These data show the similar condition that mobile learning is relatively new in China (see Figure 8.10).

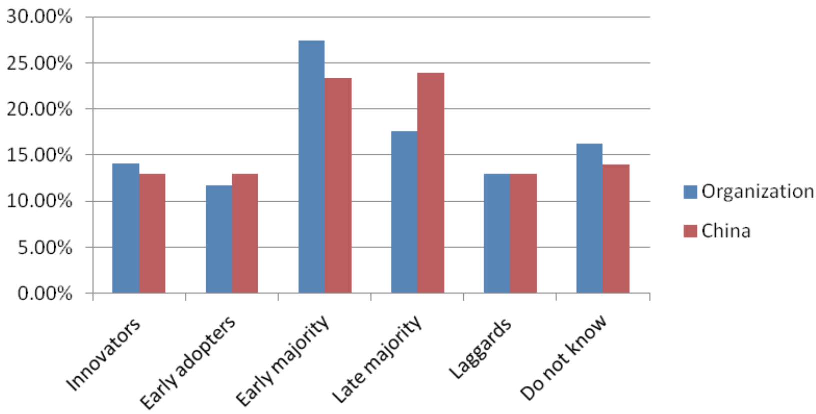

Figure 8.10 Stages of Mobile Learning

When the respondents were asked what their organizations should do to take global leadership in mobile learning, their answers focused on spreading the concept of mobile learning, developing mobile learning equipment, improving the mobile learning network connection. The survey also verified Wang's et al. (2009) finding, after they experience mobile learning, 95% of the respondents said they like mobile learning. The respondents thought that curiosity about mobile learning would transform into interest. Keeping the interest, learners would gain high satisfaction from mobile learning, because of the time flexibility and location freedom of mobile learning.

Conclusion

Current research on mobile learning includes: the mobile learning concept, theoretical research, the corresponding implementation mode, and the learning theory of mobile learning. At this stage, the propagation of the mobile learning concept is the most important. Except for the education and research fields, common people have no idea about mobile learning. Mobile learning related technology research is also still in a primary stage in China. More research needs to be conducted on mobile terminal technology, wireless communication technology, mobile learning systems and resources related development technology.

With the popularization of mobile learning and mobile devices, the problem of the lack of mobile learning resources would become apparent. Major mobile service providers of China began the projects of the "one thousand Yuan mobile phone" from 2011. The effect is very obvious. Mobile Internet usage surpassed desktop computers in the middle of 2012. Research into mobile learning would move on to a new stage. Mobile learning resources, curriculum, as well as construction of the learning environment will become the new focus of mobile learning research.

In school education, mobile learning is mainly used to improve the efficiency of student learning, promote collaborative knowledge construction, such as courses in English, medicine, art and other disciplines (Li & Chen, 2010). In distance education, based on the hardware platform of mobile learning which is nearly mature, we believe mobile learning will be rapidly spread in the near future. Mobile learning applications in corporate training in China are not common.

Mobile learning is one of the most important ways to change learning. It is impacting technology, pedagogy, human development, and even human freedom. We begin from the new features offered by technology, and then gradually make best use of new technical services in educational practice. In this process, the technology is an important driving force for mobile learning. But pedagogical issues are as important, if not more important, than technological ones. Both teachers and learners will be more concerned about the new possibilities of mobile devices and networks. Adaptive design will be implemented to meet the real needs of learners.

In China, the use of mobile devices and networks are developing very fast, especially in big cities like Beijing and Shanghai. Although the developing levels vary in different parts of the country, devices will not be an obstacle to mobile learning any more. Pedagogically related design issues are becoming one of the main focuses of mobile learning research in China.

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9

Challenges for Successful Adoption of Mobile Learning

David Topolewski et al.[1]

Abstract

Mobile learning faces significant challenges in the world's emerging economies, particularly surrounding infrastructure in rural areas. However, as these obstacles are overcome, the transformational potential from mobile learning is significant. In this article, the authors discuss the key challenges to widespread successful adoption of mobile learning, some early results they have experienced, and the potential for a real educational revolution from these personal, always-connected devices.

Introduction

In the near future, over one billion smartphones will be sold every year (Pathak M., 2013). For China to become the largest PC market it took decades, for smartphones only few years, exemplifying the astounding rate of digital acceleration. With billions of mobile devices in the hands of ordinary citizens, the question becomes how best to utilize this incredible opportunity to improve education for so many. The potential is unquestionably massive but, both in developed and developing economies, there are numerous challenges that must first be overcome. Given that developing countries face larger challenges, these challenges and potential solutions will be discussed in greater detail.

Next, since mobile learning solutions are being delivered to both developed and developing economies in Asia, experiences with mobile learning, specifically with both parents and teachers will be featured. These two groups have integral roles to play in the adoption and success of mobile learning for K-12.

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1. Other authors include: Shi Annie (Yongxia), Yin Shubo, Sita Pallacholla.

The discussion then moves to the tremendous expansion of mobile learning opportunities and early mobile deployments. Just as the user experience and resources now on the Internet are so much better than during its early days, there is a similar trajectory with an even greater potential with mobile devices. Unlike PC's, mobile devices are always on, with the owner, personal, and connected. Over time, standardization is expected to increase across platforms so that services will run on multiple operating systems and device types, enabling a better and broader offering of services. Continued technological innovation will drive costs down and functionality up on the devices and infrastructure improvements will serve as the foundation for better mobile learning services.

Finally, conclusions and thoughts for further research in the rapidly changing landscape of mobile learning are presented.

Challenges in Southeast Asia and China

Qooco is an international provider of mobile language learning solutions with deployments in China, Japan, Singapore, Indonesia, Cambodia, Malaysia, Vietnam, and Myanmar with first-hand experience on the challenges of such deployments, particularly in developing countries. These challenges can be classified as infrastructure-related, technical, and economic. Depending on the location, some challenges present more difficulties than the others.

Without a doubt, the most difficult problem to resolve in rural areas is procuring quality Internet connectivity. This is particularly true in mountainous regions. In quite a number of countries, fixed broadband, Wi-Fi, and 3G Internet access is widely available in urban areas. In rural areas, however, wireless access is much less accessible. Countries such as Indonesia face particularly strenuous challenges with their many islands and large mountainous areas. In many of these areas, mobile phone coverage is very weak even for phone calls, much less data connectivity (Firdaus F., 2013).

In Thailand, 3G has been delayed repeatedly because regulatory issues, although its fixed broadband is quite good (Sullivan B., 2012). In Cambodia, on the other hand, where Qooco is supporting English teaching at an orphanage with WholeTree Foundation and the YMCA of Singapore, there is fixed broadband at the orphanage, and then Wi-Fi provided for the students to use Samsung GALAXY Tab 2 7.0 tablets to learn English.

In Singapore, residential broadband is excellent, with many households having fiber optic lines. However, due to having the highest penetration of smartphones in the world, mobile broadband access speeds are quite low over 3G networks.

Japan has state-of-the-art infrastructure and the cheapest broadband in the world. An entry-level offering is 100 Mbps optical fiber to the home and its smartphone and tablet markets are very competitive, with a wide variety of devices available at good prices (Gigaom V., 2013). Its three mobile carriers, NTT DoCoMo, SoftBank, and AU, compete aggressively. Although the mobile infrastructure is excellent, however, Japan exhibits relatively little use of technology in education. In public schools, very few PC's are used (Merrow J., 1997). It is ironic that the country with the best broadband and mobile infrastructure has made the least technological innovation in education (Suzuki Y, 2012).

In China, one of the biggest challenges is educating its population at all, simply by virtue of the sheer population of 200 million plus students. China is currently running an experiment called the "electronic school bag project" in Shanghai with about 10,000 students using tablets. The goal is to understand how students and teachers use these in school and at home, with attention focused on what is and is not done well. This pilot will form the basis for revisions on content, ease of use, training, and deployment. China currently has a network of over 20,000 "experimental schools", which it uses to refine changes in teaching, content, and management. These schools provide feedback for effective national deployments.

In general, Internet access is not a problem in China. It has a competitive market with China Telecom, China Mobile, and China Unicom based on improved services. Prices are relatively stable, but more services and higher bandwidth continue to be introduced for no extra charge.

For a number of the countries covered, internet access is excellent, but telecoms, governments, social businesses, and others must continuously cooperate to improve network penetration. It is not just an issue for education, but also for communication, health, empowerment, entertainment, and overall quality of life.

Electricity is the next major issue that requires addressing in terms of infrastructure. The good news is that portable solar panels are available, and while the cost is still too high for mass adoption, prices are expected to decline significantly in the next 12 to 18 months (Solaron, 2013). In the meantime, solar chargers add to the cost of the total mobile solution, but for smaller, remote installations, they are far more practical than bringing in electricity from the power grid and can be implemented incrementally. While not as inexpensive as commercial power, it wins out on speed and targeting.

Technical Challenges

With respect to technical challenges, some are more under the control of the solution provider, while others are more difficult. In looking at the main providers of tablets and smartphones, iOS and Windows 8 seldom change their operating systems. In contrast, Android has gone from version 2.2 through 2.3, 2.4, 3.0, 3.1, 4.0, and 4.1 in just over a year. In addition, we must consider numerous screen sizes and resolutions. For developers, this is a significant investment of resources in development, testing, and support for their products.

A technical challenge that developers face, but outside their control, is language support. While Windows PC supports Khmer for Cambodia, Android supports neither Khmer nor Burmese at this time. Google must deal with this issue of language support. Apple supports Thai, Malay, Indonesian, and Vietnamese, but not Burmese and Khmer and Windows does not have support for Burmese.

Furthermore, large scale deployments, such as what the Thai government planned for Thailand, requires device management solutions. In the Thai case, the government plans to buy one million Android tablets for primary school students. In order to keep the tablets up to date, ensure safe web browsing, add and delete applications, maintain security, implement theft control, and provide proper maintenance, among other functions, it is necessary to have a robust mobile device management system. There are numerous commercial solutions available, but they add significantly to the cost of the purchase. For instance Cloud based services cost around $60 per device per year (Rubens P., 2012).

Depending on whether the m-learning is offered as a consumer offering or an institutional offering, there are technical challenges for payment as many countries lack the financial institutions that are so common in the developed world. For example, Singapore is a very developed market for mobile devices and apps with no shortage of inexpensive payment options. In Indonesia, however, credit card penetration is low, which is problematic for users attempting to access the Apple, Microsoft, Android, or other app stores. Instead, the vast majority of people use premium-SMS (P-SMS) to purchase items through mobile devices. There are, however, several challenges inherent to P-SMS. The telecom operators take 40% to 60% of the revenues for payment services. This high cost for payment services does not include any data, hosting, or marketing, but for payment only. This creates major challenges in pricing for m-learning providers. Next, it typically takes several months for the telecom operators to pay, causing inconvenient lag time for merchants. Finally, there are many daily and monthly restrictions on the amount charged. As a result, packaging the services becomes unnecessarily complex. To offer a better choice of payment services, Samsung has introduced S-Points, a virtual currency purchasable at many ATM's in Indonesia. S-Points opens the Samsung app store to tens of millions of people who have ATM cards, but no credit cards in Indonesia.

Based on progress in other areas such as messaging, clever app developers will find ways to provide value at much lower costs. For example, WhatsApp is estimated to cost telecoms over US $23 billion in lower revenues on SMS through its free service (Presse A. F, 2012). It is expected that telecoms will be dis-intermediated until the cost of the payment services gets closer to 15%.

Ecosystem

In the m-learning ecosystem, there are a number of costs, ranging from tablets, to electricity, to Internet connectivity, to content, to training and support. The good news is that most of these costs continue to fall.

Tablet costs, for example, are continuing to drop, which is great for consumers. There are robust 7-inch tablets running Android 4.x for US $90 each and 8-inch tablets for US $125 from Time2Talk Global in Singapore. These prices are expected to continue to decline as manufacturing volumes increase. At these price levels, they become affordable for virtually everyone. Furthermore, subsidized versions, whether from the government or corporations, are likely to further broaden the tablet's distribution. These lower tablet prices free up more funds for content, access, and other services.

The lower price points enrich the range of devices consumers can own. However, in a BYOD (Bring Your Own Device) environment, cross-platform compatibility will still be a major issue.

In addition to platform compatibility, mobile learning also changes the traditional role of teachers. Teacher training is critical to the success of m-learning. The teachers must understand not only how students use m-learning, but also how to use the reports generated, and monitor and coach their students accordingly. With Qooco's language learning service, teachers have clear reports on how well students are doing and where each one needs to focus. For many non-native English teachers, having them attempt broken oral English or correcting the pronunciation of their students is a poor use of resources. These are the teachers' weakest areas and will take years to correct. It is far better to have teachers focus on their strengths of coaching, tailored feedback, and motivation rather than their weaknesses of assessment and speaking.

There are teachers in Southeast Asia who think learning software should be free. If this mindset were to be pervasive, it would certainly slow down the adoption of mobile learning. There are some services and content that are inexpensive to offer, but many are not. In addition to Corporate Social Responsibility initiatives to offer low cost or free services, there may be Open Source offerings to address some needs. However, there would be little incentive for companies to develop their products and services without an expectation of getting paid. If teachers resist having their students pay for mobile learning, the deployment of good mobile learning solutions would be compromised. Another issue that arises is that language is very different from other subject areas. It is a skill that takes years to master. Unlike math or science, language is fuzzy. Additionally, because there are clear answers for math and science, it is relatively easy for peers to teach each other. For language, this is not true. It takes years for a student to reach a level of proficiency where it is practical for them to teach other students. This is one of the reasons why countries who want to teach language well need to start with technology teaching students and teachers at the same time. If they try to teach the teachers only, the results will be abysmal. The language problem will take at least a couple of generation to correct as students continue to suffer while their teachers struggle to catch up.

In work with thousands of students, the frequency of practice was a major predictor of success, along with actionable feedback. In order to have the latter, data is needed, yet data is the one thing absent from most classes. In looking at the foreign language programs in colleges and universities most widely viewed as successful, the class sizes are less than 12, the classes are every day for two years, and additional work outside the class is required. Given the financial pressures on colleges, the class sizes would have increased and frequency decreased long ago if they could sustain the results.

Large class sizes simply do not facilitate spoken language acquisition. There is very little data and even less feedback. This is a problem that Singapore faces with its Mandarin programs in public schools. They have excellent teachers, but class sizes of over 40 students. No matter how good and motivated both the teachers and students are, the overall results have been and will continue to be weak. The approach of large class sizes is systemically flawed. Without actionable feedback and frequent practice, the results will be the same—poor.

Of the eight UN Millennium Goals, all of the goals are directly or indirectly linked to improved education for children. These will not happen by repeating formulas that have failed in the past. Instead, innovation must be adopted for a realistic chance to achieve these goals. Only technology can scale at increasing speed and decreasing costs to provide this opportunity.

The Straits Times newspaper in Singapore did a survey of 99 parents and 27 primary school teachers attending the introduction of mSTep, a speech interactive e-workbook for English learning (iQHub, 2012). Singapore provides an interesting environment for examining mobile learning as it has one of the world's top ranked public school systems. Its teachers are recruited from the top one-third of new graduates only, the school system is well-funded, and most parents are heavily engaged in the education of their children. However, despite its strong funding, Singapore schools have large class sizes. In the survey of teachers, 81.5% of the teachers indicated they had very large (more than 30 students) class sizes and 63% had little or very little time for individual interaction with their students. Their top four challenges were class preparation, motivating their students, large class sizes, and grading.

Over 95% of the Singapore teachers used technology in teaching, although much of it was learning management systems (which are really administrative systems, not learning systems), videos, podcasts, and other non-interactive online resources. Despite this, the teachers viewed interactivity, ease of use, performance tracking, and grading all as advantages to mobile learning. In the survey, 85.2% of the teachers were interested in using mobile learning for their students.

In terms of criteria that the teachers used for selecting education technology, interactivity and engagement were at the top of the list, followed by alignment to the curriculum, grading, and performance tracking. What is interesting is that the top two selections follow the same pattern of those exhibited in the survey with the parents. Both teachers and parents understand the importance of engaging the students in their learning. Parental alerts and performance tracking followed in deciding on selecting education mobile learning services. In the survey only 35.4% used education technology for their children, while 81.8% indicated that they were interested in using mobile learning.

There are very interesting implications from these surveys in Singapore. One is that there is a high degree of openness to mobile learning by both parents and teachers. There is also significant alignment between what each individual views as important in selecting of mobile learning apps and solutions. Yet, there are also the challenges the teachers highlighted. In particular, the large class sizes and limited time for individual attention are problematic for English teaching even for a well-funded school system in a country where English is the first language. For school systems that have fewer resources, and where English is not the first language, the obstacles for effective English language learning will be much higher. It simply is not realistic to attempt second language learning in the traditional way.

Preliminary Outcomes

Based on student enthusiasm, ease-of-use, low cost, prior results on PC's, and mobility, we expect the learning results of m-learning to be strong. In a prior pilot done in China, students using PC's improved their spoken English scores by 55%, while the control group improved by only 11%. It is worth noting that the control group in this pilot had much lower student/teacher ratios than would ever be possible in a public school environment.

Tablet pricing, which continues to drop, makes them far more affordable for many people. This, in turn, leads to less sharing of devices, and more individual use. Frequent practice, critical to success in spoken language learning, becomes easier as a result. The instant-on feature of tablets and smartphones allow 2-minute lessons anywhere, anytime in "niche time".

Qooco has a pilot in Cambodia underway, with other pilots starting in Myanmar, Singapore, and India in the near future. The results of these pilots will be found at www.qooco.com/research/pilots.

The Upcoming Revolution in Mobile Learning

The onslaught of mobile devices will create a revolution, not just in mobile learning, but in education overall. The elements that are driving this revolution are access to world class content for a fraction of its historical costs, quality analysis and feedback, accountability, adaptive learning, teacher training, and an ever-increasing amount of data.

Most of the costs of mobile learning are dropping—devices, connectivity and bandwidth, solar charging, and content. As users increase, the costs decrease. In the meantime the traditional paper publishers have rising costs and little scale. On top of that, so many free resources are suddenly at the fingertips of students and teachers.

However, the much lower costs possible with m-learning are just one aspect of the benefits. Differentiated learning, peer-to-peer learning, collaboration, higher quality instruction, meaningful interactivity, gamification, and formative assessment are also major components of mobile learning.

Mobile learning will push students from learning passively to actively. With continuous assessment, it becomes possible to identify weaknesses and correct them immediately. For example, from being involved with the E.W. Scripps Spelling Bee in China and Japan, Qooco has come across students who can memorize words, but have no idea what they mean, rendering their memorization useless. To counteract this problem, exercises and games that require knowing the definition and using their vocabulary were added. Now, the students who memorized words to compete are forced to also incorporate useful learning. Through the use of formative assessment, more valuable feedback can be provided to teachers. Feedback that is both timely and actionable.

With the widespread collection of data, school administrators can now get a much clearer picture on how specific students and groups of students are doing. Experimentation is much more valuable for continuous improvement than sticking with outdated models from centuries ago, something Michael Crow, President of Arizona State University calls “filiopietism”, excessively honoring tradition (Selingo J, 2012).

One thing that technology will do is to push down the cost of school materials. Tablets and smartphones can store thousands of books, many of which are past copyright protection and thus available for free. However, even more benefits will come from adaptive and collaborative learning, where student are helping other students.

Looking at what happened to Encyclopedia Britannica after Microsoft’s Encarta was released is a valuable lesson here. Encarta, which was available for a fraction of the paper encyclopedia’s price, vastly outsold Encyclopedia Britannica. In some ways, Encarta may not have been as good as the paper encyclopedia, but it was much cheaper, easily searchable, portable, and simply a better value proposition. Eventually, Encyclopedia Britannica changed its business model and has finally become profitable after many years of losses. Traditional publishers would do well to learn from Encyclopedia Britannica, as they, too, will have to trade paper dollars for digital pennies. A massive change awaits the publishers.

However, if publishers want to remain relevant in education, they must add more value to their publications. Adaptive learning holds much promise by adapting the learning experience through the choice and sequence of material. Some students may be doing particularly well with a section of a book, so they can skip it or be provided more challenging material, while others students may require remedial help.

For adaptive learning to be widely implemented, open standards will be needed so that all the information collected from a student working with an interactive book can be put in one place for teachers and parents to review. If publishers attempt to create their own proprietary systems, they will face resistance from schools, teachers, and parents and slow down adoption of adaptive learning. Here, large school systems, as major buyers, can provide the catalyst for open standards.

With those open standards, the amount of data collected during actual learning will be enormous. This, in turn, offers many opportunities for analysis, improvement, and accountability. Instead of the summative assessment, which characterizes the vast majority of assessment done, teachers and researchers will have access to formative assessment, which is far more useful to them in helping students. Students can be helped on a timely basis, rather than waiting, in many cases, for years. With relevant and timely data, real quality control can be implemented into school systems for the first time. This is a powerful management tool. They will have a holistic view, not just of each student, but also of each class, teacher, school, and school system. It will open up tremendous opportunities for research and improved learning methods.

A number of countries have announced initiatives or started trials to use tablets in schools. Korea, for example, is planning to phase out textbooks in favor of tablets (Piejko P., 2011). Thailand has announced that it is purchasing one million tablets for primary school-aged children (SAPA, 2012). China is experimenting in Shanghai with tablets to see how they can best be used for education. Turkey has put tenders out for tablets for its education system (TODAY'S ZAMAN, 2012). There will be many others that follow.

However, before mobile learning can be properly implemented, teachers must be trained and the role of teachers changed. Much as in "flipped classrooms", where lectures are watched online at home and exercises are done in class with the teacher and other students, the role of the teacher changes as well. Many technology initiatives in education have failed because of the lack of teacher training and engagement. As a result, school systems need explicit training programs to ensure that the teachers are proficient with the new systems and full engaged. Otherwise, the results will be poor.

With social networking features built into most mobile education technology services, a world of collaborative learning opens up. Students learn best by doing and teaching others. Mobile learning provides a unique, always-on, and personalized connection to other students, enabling ubiquitous learning. Add to this appropriate gamification, and a whole new level of engagement is possible for students.

Conclusion

In reviewing the challenges of mobile learning in Asia and examining some of the early results, it is clear that at least some of these challenges need to be overcome for the mobile learning revolution to take place. There are several groups in the mobile learning ecosystem, some of which have different goals and agendas. For example, the mobile device manufacturers have a number of different services they are focused on, ranging from eBooks, entertainment, productivity applications, mobile health, and numerous others. Because of the multipurpose nature of mobile devices, much of the innovation done for these other areas can benefit mobile learning. With the large outsourced manufacturing systems in place, particularly in China, the ability of continued innovation and strong competition will continue, driving prices down for mobile devices.

In contrast to the many players in the mobile device design and development, the infrastructure wireless services have relatively few players in each country. As a result, they have much more power compared to other players in the ecosystem. Since they are the critical controller of access, especially in rural areas where it may not be economically feasible to have more than one supplier of wireless access services, this may be one area that the national governments may play a persuasive role, such as what China has done in its markets. Competition drives better services for customers. Once the infrastructure is in place, mobile learning is well-positioned for a bright future and a major positive impact on humanity.

In closing, mobile learning will provide enormous amounts of data for analysis. This will provide a treasure trove for researchers to analyze learning inputs, practices, and outcomes. If such data is provided to the research community and not kept proprietary, it will be the catalyst for immeasurable future benefits.

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10

Location-Based Learning with Mobile Devices

Qing Tan Nashwa El-Bendary

I never teach my pupils; I only attempt to provide the conditions in which they can learn.
——Albert Einstein

Abstract

Novel and emerging pedagogical trends have coupled the power of information and communication technologies bringing dramatic change in the educational scenery, transforming the breadth, depth, and opportunities for learning. Mobile learning is an emergent paradigm empowered by that intense development and convergence of the technological advances in ambient computing and mobile communication in addition to the development of smart user interfaces. Additionally, the location-awareness characteristic of mobile devices added the essence of sensing and reacting based on location-based environments to the location-based mobile learning environments that use mobile devices.

This chapter attempts to bring to light the concept of location-based mobile learning using learner's mobile device. So, technologies and applications emphasizing on the location-awareness concept will be discussed along with the most useful learning activities that can be supported by location-based mobile learning applications and technologies. Moreover, this chapter highlights the 5R adaptive framework and the Augmented Reality integration in location-based mobile learning in order to provide some leading guidelines for recognizing location-based learning practices and effective pedagogies incorporated in a particular "learning space" with the support of mobile devices.

Introduction and Background

Recent advances in mobile technologies and cellular communication network have extended the usages of mobile phones to reach areas far beyond their original telecommunication functionality. Lately, mobile phones have been used as powerful data communication devices and portable entertainment tools. Accordingly, it can be noticed that the number of mobile devices accessing the Internet has been increasing rapidly over recent years (Zawacki-Richter, et al., 2009). According to research conducted by Ipsos (http://www.ipsos.ca) and Verizon (http://www.verizonwireless.com) during late 2011 and early 2012 surveying mobile device adoption and usage trends in US, UK, France, Germany, and Japan, findings showed that 38% of US mobile subscribers own smartphones. Also, comparing the US with the UK, France, Germany and Japan, the highest penetration of smartphones was found in the UK at 45%. In the USA, 69% of mobile users access the Internet on their phones daily and an even larger percentage of Japanese users (88%) accessing the Internet on mobile devices every day.

From the turn of the millennium, educators started experimenting with wireless and mobile technologies and the concept of mobile learning (m-learning) began to emerge. There is currently a globally rapid rate of development and application of wireless and mobile technologies in contemporary learning environments and learning paradigms. Apart from mobile phones, other wireless and mobile computational devices such as laptops, palmtops, PDAs (Personal Digital Assistants) and tablets also rapidly entered the market—some devices, of course, have exhibited more success than others for particular markets. According to the increasing importance of the mobile computing sector in computing science, mobile learning has been adopted by many learners and it has been considered as an effective way for learning anytime and anywhere.

Because of the advanced wireless telecommunication infrastructure, for example, 4G cellular networks and enlarged mobile computational capacities, mobile devices have much stronger capability to implement client—server-based mobile learning applications. Furthermore, the upgraded mobile operating systems and enhanced mobile device middleware and native features may provide learners with authentic learning activities. The wide cellular network coverage, mobility, and portability of mobile devices have set the framework for ubiquitous and asynchronous learning (Chu, et al., 2008; El-Bishouty, et al., 2007). The unique characteristic of mobile devices is their location-awareness that enables the development of mobile learning applications with strong interaction capability. The advanced functions of mobile devices enable mobile learning applications to sense location and to identify learners' learning environments.

This chapter attempts to bring to light the concept of location-based mobile learning using the learner's mobile device in order to address some of the technological, pedagogical, and educational issues in location-based mobile learning environments. Furthermore, technologies and applications emphasizing the location-awareness concept will be discussed considering mobile client software design principles and mobile computing architecture for multiplatform adaptation from the technology prospective. Also, the chapter identifies the key elements that are unique to mobile learning, and surveys the most useful learning activities that can be supported by location-based mobile learning applications and technologies. Moreover, this chapter highlights the 5R adaptive framework in order to provide some leading guidelines for recognizing location-based learning practices and effective pedagogies incorporated in a particular "learning space". Additionally Augmented Reality integration in location-based mobile learning will be explored as it could greatly impact the research and development of location-based mobile learning via mobile devices in terms of human-machine interaction and mobile learning contents generation and presentation.

From Distance Learning to Mobile Learning

Mobile learning (m-learning) is considered to bring about a paradigm shift in distance learning (d-learning) via offering new accessibility and flexibility opportunities for mobile learners. Accordingly, the employment of strategies and approaches within d-learning can assist with the formulation of the m-learning concept as well as the development of applications for this emerging learning medium. Information and communication technologies (ICTs)—especially mobile devices—open up new paths for learning support and opportunities to reach a wider audience of learners. Learning support systems in various forms have existed in traditional distance learning for decades. However, considering the new ICT technologies, mobile devices have opened up new paths for learning support and opportunities to reach a wider audience of learners (Zawacki-Richter, et al., 2009).

Distance learning can be characterized as the all-inclusive umbrella term for media-based learning. From one perspective, m-learning can be viewed as a subset of d-learning concept that includes online and mobile learning environments. In this regard, Quin (2000) defined m-learning as d-learning through mobile computational devices. Mobile learning devices are defined as handheld devices and can take the form of personal digital assistants (PDAs), mobile phones, smartphones, audio players (such as the Apple iPod), video and multimedia players, handheld computers and even wearable devices. They should be connected wirelessly, thus ensuring mobility and flexibility. They can be stand-alone and possibly synchronized periodically, intermittently connected to a network, or always connected (Zawacki-Richter, et al., 2009). On the other hand, another perspective that adds a new dimension for m-learning is considering m-learning ubiquity and context/location-awareness. So, mobile learning is not only about the mobility of the learner or the device, but also mobility across contexts. As authors spend more time physically on the move, it is essential to realize that contexts might change rapidly; this is also true in the more long-term sense of change, which might encompass lifelong learning. Also, location-awareness is divided into quantitative and qualitative location models, which allow working with absolute and relative positions. Moreover, via combining both d-learning and m-learning with the traditional face-to-face learning approaches the "blended learning" is shaped. Figure 10.1 presents the relationship between d-learning, m-learning and blended learning (b-learning).

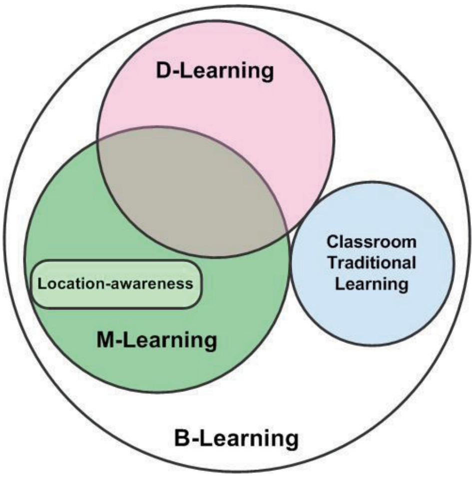

Figure 10.1 The Relationship Between D-learning, M-learning and B-learning

Review of Literature

Research into mobile learning will bring the rewards of placing institutions at the forefront of pedagogical practice, answering student requirements for flexibility and ubiquity: "anywhere, anytime, and any device" access to information. As well, employing technologies, which are portable and personal, embedded, ubiquitous, and networked, mobile learning will provide the potential for rich social interactions in "real world" contexts, as well as the virtual (Cobcroft, et al., 2006). Location-based services (LBS) are one of the fundamental components in the cellular communication network. Furthermore, mobile phones with built-in GPS receiver or other type of Assisted GPS (A-GPS) services are widely available in the market. Utilizing the mobile phones' location-awareness among mobile applications has become a new trend, which is greatly changing our daily lives. However, there are many critical issues and technical challenges related to the location-based adaptive mobile learning (Tan, et al., 2009).

Many researchers have demonstrated that mobile learning has the great advantage of incorporating location-based environments for learning (Peng, et al., 2009; Chu, et al., 2008). With advanced wireless telecommunication networks and mobile technologies, the integration of location-based environments for learning through mobile devices has become much more effective and efficient. Applying mobile device's location-awareness features, context-aware mobile learning has unique and remarkable strength in implementing location-based environments for mobile learning. In recent years, there have been several interesting and innovative location-based applications, such as Environmental Detectives (Klopfer and Squire, 2008), Butterfly Watching (Chen, et al., 2005), CAERUS (Naismith, et al., 2005), Ambient Wood (Rogers, et al., 2004), Savannah (Facer, et al., 2004), and Riot! 1831(Reid, et al., 2004) that could be used in mobile learning environments. Another example of mobile application for informal learning is "Word Lens" that translates instantly printed words from one language to another. It can be used as a great tool for language learning in location-based environments (Reid, et al., 2004). There are also some location-based mobile applications that enable mobile learning in location-based environments, such as "Geocaching" software and location-based games (Tan, et al., 2012). Also, a model of personalized collaborative ubiquitous learning environment are proposed (El-Bishouty, et al., 2007) to support the learner while doing learning tasks or activities, which utilizes the Radio-frequency identification (RFID) technology to detect the location and the real (physical) objects that surround and provides the learner with different Knowledge Awareness Maps. The proposed model then was enhanced to dynamically generate social knowledge awareness map according to the learner's current context (El-Bishouty, et al., 2010). Then, it allowed the learners to interact with the physical world in order to develop their learning experiences in using the real objects; whereas, the learner can receive aged-based recommendations (El-Bishouty, et al., 2010). Moreover, a ubiquitous learning environment was presented for supporting learners with a system to share and reuse learning experience by linking movies and real objects using RFID tags (Ogata, et al., 2009). Ogata, Yin, El-Bishouty and Yano (2010) presented computer-assisted language learning in a ubiquitous computing environment that facilitates sharing past experiences. Moreover, a Learning Log Navigator has been proposed (Ogata, et al., 2011), which is a mobile-based system for Android phones that allows the learner to navigate through the learning log objects. It provides the learner with a live direct view of the physical real-world environment augmented by a real time contextual awareness of the surrounding objects.

Regarding the potential of mobile learning in developing countries, Africa is leaping from an unwired, non-existent d-learning infrastructure, to a wireless d-learning infrastructure (Brown, 2004). So, currently the mobile learning activities in Africa range from the use of PDAs in assessment strategies (e.g., the clinical assessment of medical students) and PDAs in wireless learning environments (e.g., engineering students for collaboration and coursework) to the use of the most basic mobile texting functionality (SMS) for learning support (Brown, 2006). This reaffirms the importance of mobile learning systems and accordingly the importance of the location-awareness characteristic of those systems.

Rationale for Location-based Mobile Learning

Considering mobility from the learner's point of view rather than the technology's, it can be argued that mobile learning goes on everywhere. For example, learners revising for exams on the bus to school, doctors updating their medical knowledge while on hospital rounds, language students improving their language skills while travelling abroad (Vavoula and Karagiannidis, 2005). All these instances of learning have been taking place while people are on the move. So, as mobile learning is happening when the learner is not at a fixed or predetermined location, using the support of location-awareness provided by the learner's mobile device will expand the utilization of the mobile learning system in various ways.

One of the main characteristics of location-based mobile learning systems is grouping learners together based on their location information in order to enhance collaborative learning. Simply using location information alone may not result in an optimal solution from the learning perspective.

Learning Factors: Profile, Style, and Interest

Many learning factors can formulate a distinct profile for each learner and can as well have influence on the learner's learning behavior, such as the learner's background, age, learning history and previous learning performance, and educational level. Learning style is also considered as an important feature.

Learners with a similar learning style tend to have more interactions with one another during their learning. Hence, learners who are similar in learning profile and style tend to profit more from interaction in situations where collaborative learning is necessary (Tan, 2010). Figure 10.2 shows the attributes of the Felder-Silverman learning styles model (Felder and Silverman, 1988) that is widely applied in mobile learning applications to analyze learners' learning styles.

Figure 10.2 Category of Felder-Silverman Learning Styles Model

So, back to location-based learning groups, each learner's interest is taken as a key characteristic within the context of a learning group. Interest is defined as a content-specific motivational characteristic encompassing the depth of text comprehension, the use of learning strategies, and the quality of the emotional experience while learning (Schiefele, 1991). The premise is that learners with similar interests, in a group, can facilitate their learning when pursuing specific learning objectives.

Mobile Technology Support for Location-Awareness

In mobile learning settings, learners are able to interact with learning environments by means of the mobile learning application's interactive functions. Many interesting mobile applications can be employed to assist learners in location-based mobile learning environments using the support of mobile devices.

Mobile Virtual Campus (MVC)

A good example for a collaborative mobile learning group system is the Mobile Virtual Campus (MVC). The MVC system has been developed to provide an innovative and interactive platform for online mobile learners by utilizing the location-awareness and other built-in sensory components in mobile devices (Tan, 2010). On the platform, the mobile learners can learn collaboratively and interactively either at a distance or face-to-face in the mobile learning environment. Within the MVC, mobile learners can share the learning experiences with their peers just like in a traditional classroom. The learners in a MVC share the closeness in geographical location and have similarity in the perspective of learning profile, learning style, or learning interests. The MVC extends the virtual campus concept into the mobile learning environment and it is inspired and motivated by the unique location-awareness feature of the mobile devices. Within the mobile virtual campus, the members can easily get together to experience and learn the nearby location-based learning contents; the members also are more affective to share their learning experiences, to exchange their knowledge, and to inspire each other because of the similarity, especially they are able to meet face to face.

iCollaborator

iCollaborator is another example for collaborative application in a mobile learning environment. iCollaborator is an iPhone application that was developed at Athabasca University to provide multimedia mobile meeting and an interactive virtual whiteboard in which participants can effectively communicate and exchange ideas in a real-time manner with location-aware aspects (Lo and Tan, 2010). With the iCollaborator, learners can have real-time communication and exchange ideas with others to assist their learning from their everyday life.

iCollaborator application provides the facilities for browsing files within the local and online file system. It is able to obtain and store location information for both a picture taken and the saved whiteboard, which can be accessed through the Whiteboard Info button. Simple session information can be displayed using the session info view, indicating simple network information such as IP address, name of the user, and other users connected to the same session.

Screenshots for both MVC and iCollaborator applications are presented in Figure 10.3 and Figure 10.4 (Tan, 2010; Lo and Tan, 2010). Moreover, a comprehensive survey of many currently available commercial m-learning supporting applications is presented by Brown and Diaz (2010).

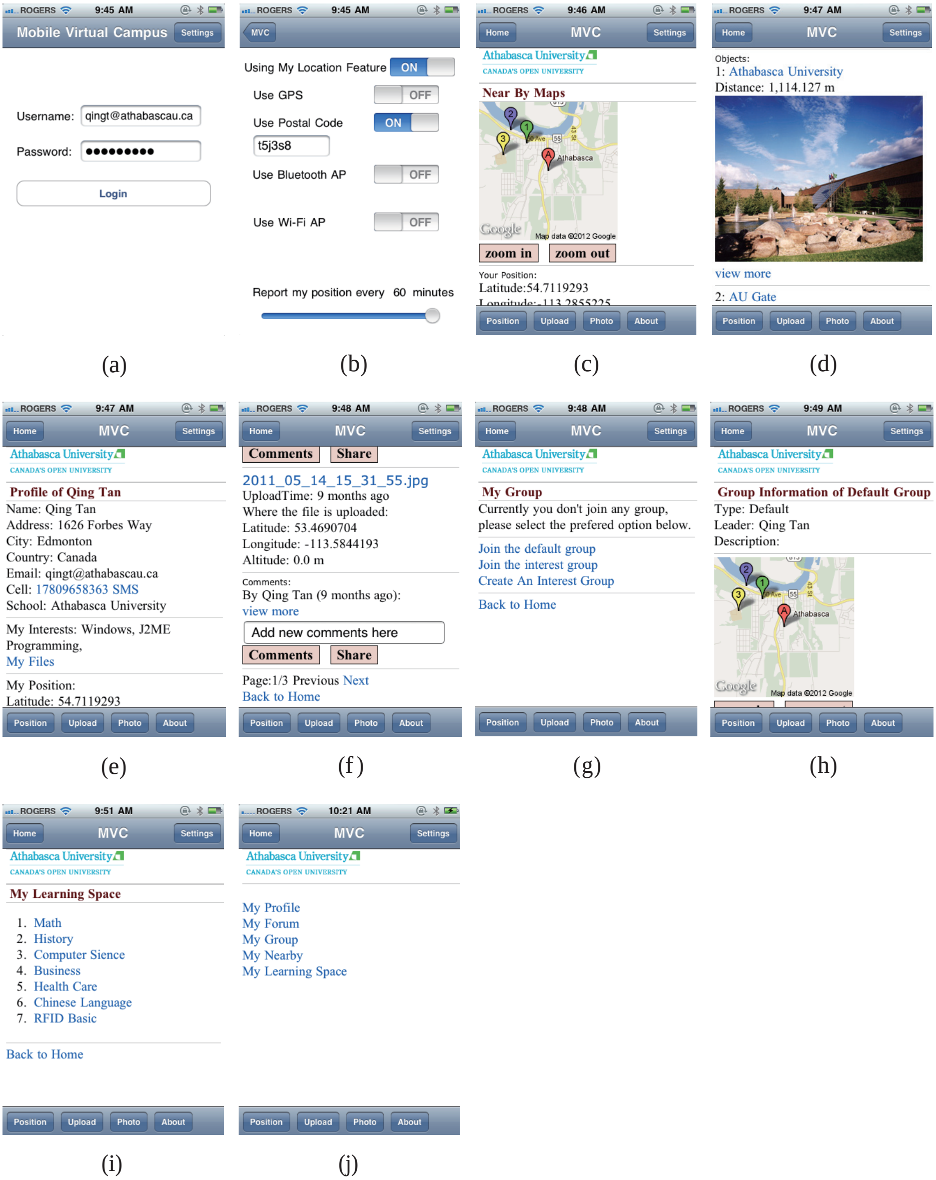

Figure 10.3 The Mobile Virtual Campus (MVC) System (Tan, 2010)

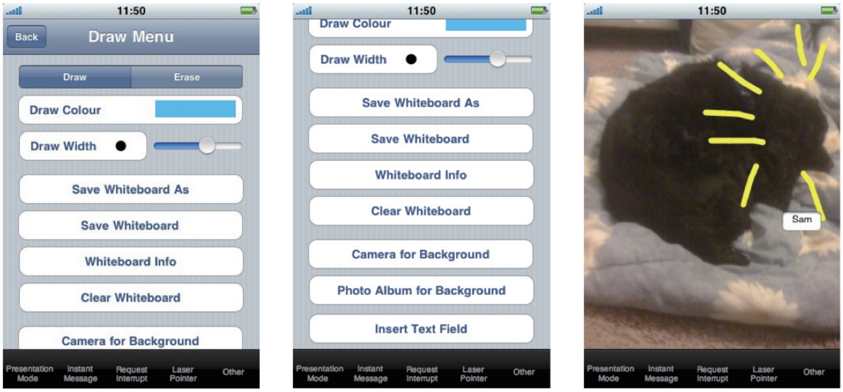

Figure 10.4 The iCollaborator's Interfaces and Whiteboard (Lo and Tan, 2010)

Augmented Reality Integration in Location-Based Mobile Learning

In traditional learning model, the learners acquire learning contents from teachers, textbooks and paper materials of in-door classes, or by d-learning from any e-resources via the Internet through a PC, Notebook or even a Net-book. These traditional learning models provide a completed, plentiful and a great quantity of learning contents via showing high completeness of learning information on one specific topic textbook or even on a single page, and most of these learning contents are expert-oriented (Tan, 2010). However, on the other hand, such traditional models are still confronted with many limitations, such as the generalized conceptual knowledge nature of most learning contents in textbooks and materials no matter whether for in-door or out-door classes. Also, for a learner, it is not easy rapidly and effectively to find specific information or even a single solution, which is able to directly be suitable for the learning objects or tasks when he/she needs it. In other words, it is not always possible to have plentiful time or a library just nearby, not to mention that you would also have to find an information from a large number of materials. Another important limitation is that most parts of these learning contents are all teaching-oriented, which means that the learning contents from those textbooks or materials are designed for a teacher or even a specific class to teach in classes and it is naturally believed that they can be learned effectively by the students.

As m-learning can be ubiquitously conducted, anytime and anywhere, it provides the opportunity for mobile learners to learn collaboratively while they are online and in the mobile learning environment. Utilizing a mobile device's location-awareness capability within mobile learning applications has become available. Although the GPS may not be accurate enough because in the location-based mobile learning environment there might be a lot of learning objects in a single location, and each object has its specific learning contents belonging to it.

Augmented Reality (AR) is a concept that provides allowing users to see the real world with virtual objects superimposed upon or composited with the real world. Therefore, differently from the Virtual Reality (VR), AR supplements reality, rather than completely replacing it. Ideally, it would appear to the user that the virtual and real objects coexist in the same space (Azuma, 1997). Figure 10.5 shows two examples of using AR applications on location-aware mobile devices in two different locations.

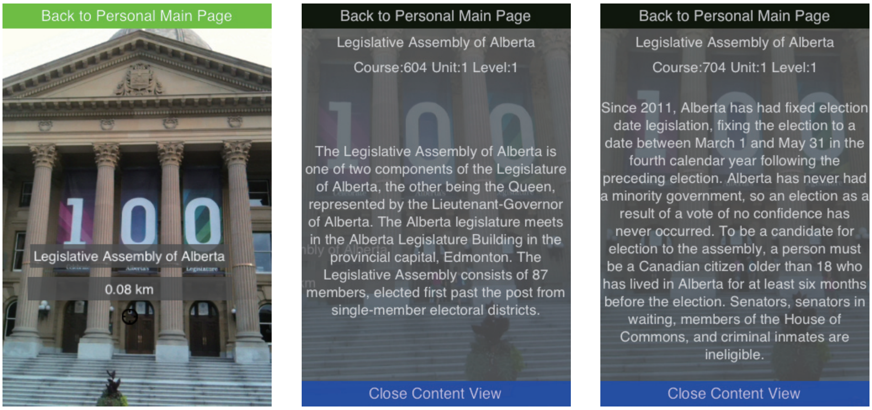

Figure 10.5 Location-Based AR Application for Adaptive Mobile Learning

So, utilizing approaches based on the Augmented Reality concept and the location of m-learning objects will allow learners to see suitable learning contents superimposed upon the specific learning objects and enhance the interactive in a mobile learning environment. Learning-Object Oriented Guidance ability, and high interactivity, are all characteristics of applying Augmented Reality in location-based m-learning environments that will enhance the learners' knowledge as more adaptable, accurate, personalized and interesting as possible. Accordingly, that allows a learner to see the real learning object coexisting with specific learning contents when they are using their mobile device to complete their learning tasks. Moreover, there are a lot of research works considering using AR as a new way to display the learning contents on the mobile learning environment (Tan, 2010; Liu and Chu, 2008; Schall, et al., 2008; Kaufmann, 2003; Doswell, 2006a; Doswell, 2006b).

The 5R Adaptive Mobile Learning Framework for Location-Based Mobile Learning

The 5R adaptation concept for location-based mobile learning is stated as "at the Right time, in the Right location, through the Right device, providing the Right contents to the Right learner", with the goal of providing a solution and a standard structure for implementing wider-ranging adaptation for location-based environments for mobile learning. This adaptation concept aims to enhance learning in location-based mobile learning environments by taking the factors of learner, location, time, and mobile devices into consideration (Tan, et al., 2011).

The 5R adaptation framework imposes the adaptation of constraints through the 5R adaptation mechanism to generate the 5R adaptive learning contents. The 5R constraints can be semantically presented and accessed during the automatic decision-making process for generating personalized learning content "filter". The framework provides learners with adaptive learning contents based on their learning profiles and learning styles, additionally to adapt to learners' current locations, times, and devices. Figure 10.6 illustrates the concept of the 5R adaptation framework. The 5R framework is essential in the definition of the learner's system and in the provision of location-based environments. That's due to the requirement of the learning system to track down where the learner is, and which location-based environments are near to the learner, and if they are accessible at the time when the learner is located in that particular environment. Thus, the system has the capability to automatically alert the learner when the learner is approaching to or is at a particular location and then to provide the learner with the right learning contents (Tan, et al., 2009).

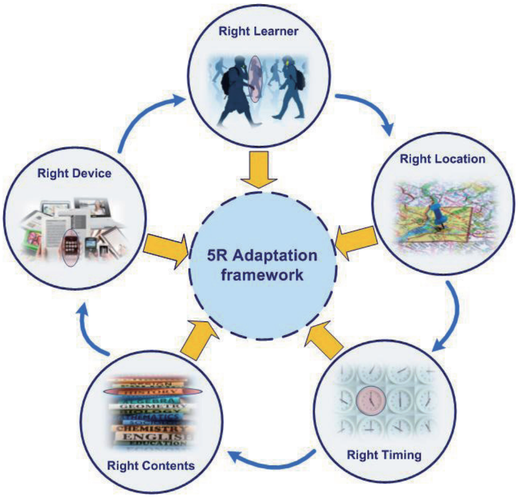

Figure 10.6 The 5R Adaptation Framework Concept Diagram

A detailed description of the 5R considered by the adaptation framework is presented in Table 10.1 (Tan, et al., 2012).

Table 10.1 A Description for the 5R Considered by the Adaptation Framework

5R	Description
The right time	The time in the adaptation framework indicates two factors: · The date-time, · The learning progress sequence. The learning contents associated with the location-based environments are with a date-time constraint that reflects the time and date when the location-based environments are accessible, such as a lab, library, or museum. The learner's learning progress sequence is also considered as a time factor. Since mobile learning takes place anytime, by including the time constraint, the mobile learning system is able to provide the learning contents at the right time
The right location	The location in the adaptation framework indicates a "learner's current geographic location". Location-awareness of the learner's mobile device is used to sense the learner's current geographic location. When the mobile learner is physically at or near particular location-based environment, the learner could be assigned to conduct location-based learning activities to complete learning tasks at the location. Since mobile learning takes place anywhere, by including the location constraint, the mobile learning system can provide the learning contents in the right location. Location-based environments for learning have the unique ability to provide the location adaptation
The right device	The device in the adaptation framework refers to the learner's mobile device that is used to conduct mobile learning. The device adaptation is also the distinctive feature of mobile learning compared with other computer-assisted learning scenarios. From its nature, mobile devices are "heterogeneous", and therefore, it is essential to provide the right format of learning contents to the right mobile device. The device adaptation can provide learners with the best possible learning experience in terms of the use of a particular mobile device
The right content	The content in the adaptation framework includes "learning objects", "learning activities", and "learning instructional materials". Learning content can be constructed or retrieved based on the learning objectives, pedagogy, and academic structure. The right learning content will suit the learner's learning objectives and learning style at any particular time and in association with location and the particular mobile device used

Table 10.1 (Continued)

5R	Description
The right learner	The learner in the adaptation framework is "the individual who conducts learning" through a mobile device in the location-based learning environment. A learner's learning profile and learning style have been taken into account in order for the learning system to identify the learner's individuality and personality compared to that of other learners. The learner's profile information contains the learner's learning objectives, learning progress, learning behaviors, and learning assessment results. The right learner means that the learner receives the learning contents provided by the learning management system "matching" with the learner's learning profile information

Conclusions and Open Research Directions

Mobile devices and applications are expected to be only one of many types of computing devices used in future. Based on the issues formerly presented in this chapter, one of the main findings is that teaching and learning strategies and methodologies are currently and will keep adapting continuously due to new affordances that technology provides. On the other hand, it can be expected that learning theories will remain the same in essence, but that new learning paradigms and learning strategies would emerge because of technological developments. In general, the fact that mobile learning would be very helpful, in enhancing teaching and learning independent of time and space, can be concluded.

M-learning is a promising approach for enabling the learning process to be even more flexible and spontaneous than traditional d-learning and in principle mobile learning would afford new opportunities for learner support and content development and delivery.

For location-based m-learning systems using the support of mobile devices, some of the major weaknesses of mobile devices might hinder the distribution of mobile learning and has to be considered for future research and development via the mobile industry as well as mobile communication technology providers. Also, costs of mobile network services should continue to decrease in order not to play a restricting role in the availability of those m-learning environments.

Beside the technical and economic challenges that were mentioned, another social perspective has to be considered, which is developing location-awareness mobile learning environments for learners with disabilities. This research direction has begun to be considered by some researchers, however still needs to be tackled more intensively.

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11

Mobile Microblogging: Using Twitter and Mobile Devices in an Online Course to Promote Learning in Authentic Contexts[1]

Hsu Yu-Chang   Ching Yu-Hui

Abstract

This research applied a mixed-method design to explore how best to promote learning in authentic contexts in an online graduate course in instructional message design. The students used Twitter apps on their mobile devices to collect, share, and comment on authentic design examples found in their daily lives. The data sources included tweets (i.e., postings on Twitter), students' perceptions about mobile microblogging activities, and self-reported Twitter usage. Based on the tweet analysis, we found that the students appropriately applied the design principles and design terms in their critique of design examples. While the students were mainly engaged in assignment-relevant activities, they spontaneously generated social tweets as they related peers' authentic design examples to their own life experiences. Overall, they had positive perceptions toward the mobile microblogging activities. The students also indicated that the design examples shared by peers through mobile microblogging inspired their own message design work. We synthesized instructional design suggestions and challenges for educators interested in incorporating mobile microblogging in their instructional settings.

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Introduction

The recent advances in mobile devices make mobile learning possible through the powerful computing capability built into their conveniently small sizes, their Internet connectivity, and the availability of many types of easy-to-use mobile software applications ("mobile apps" hereafter) (Johnson, et al., 2010). The major affordances of mobile computing technologies for learning include (a) mobility, the small sizes of the devices, making them highly portable, which enhances user mobility (Brown, 2009) and easy access to mobile devices; (b) computing power, relatively strong computing power, which enables users to complete tasks on small devices as effectively as on larger and less portable devices (Lai and Wu, 2006); (c) connectivity, always-on and stable Internet connectivity with high bandwidth, which allows for instant access to large amounts of information and real-time communication regardless of location (Johnson, et al., 2011). These features unleash tremendous possibilities for innovative uses in education.

Mobile technologies have the potential for innovative educational use because they allow learning to occur in authentic and meaningful contexts. Because of the mobility and strong computing power of mobile technologies, learning becomes ubiquitous and seamless (Liu, et al., 2009). Learners can now take mobile devices anywhere they want in order to execute tasks or continue their learning processes outside classrooms or traditional learning environments. Learners can also go into the field, where they can apply their knowledge and skills in real-world settings. For example, mobile devices equipped with cameras and GPS (global positioning systems) make possible a variety of educational uses, such as data collection and documentation in field learning and field research. Together, all these advantages allow mobile device users to learn in their desired or preferred locations and physical contexts.

In addition, the connectivity of mobile devices promotes social learning through communication and collaboration among learners (Zurita and Nussbaum, 2004). Social learning usually involves a group of learners who interact collaboratively to develop their knowledge or expertise in order to achieve their goals. Through sharing knowledge and experiences, learners can develop knowledge related to their field or their interests (Lave and Wenger, 1991). Mobile devices afford rich and varied opportunities for the communication and sharing (Motiwalla, 2007) critical to collaborative knowledge construction. In addition, learners can enjoy frequent and easier access to the Internet because they can be connected to the Web virtually anywhere. With the blossoming of Web 2.0 applications that emphasize participation and sharing (O'Reilly, 2005) and the increasing availability of

Web 2.0 applications on mobile devices, learning can now be enhanced in both mobile and social contexts.

Microblogging: A Web 2.0 Application for Social Learning

Web 2.0 applications, designed for communication, creation, and sharing, allow for collective and cooperative creation of content and knowledge through easy and dynamic communication and publication mechanisms (Hsu, et al., 2009). Unlike the passive knowledge consumption model of web use, Web 2.0 applications encourage and make possible a participatory web where individuals contribute and participate in the creation of content and knowledge—together. As such, Web 2.0 applications can provoke different learning perspectives, including sociocultural, situated, and distributed views (Ching and Hsu, 2011; Hsu, et al., in press). Among these perspectives, social learning is particularly pertinent to Vygotsky's sociocultural theory, which holds that learners construct knowledge through intellectual exchanges during their social interactions. In this view of learning, the social environment plays a critical role in enabling individuals' development and learning (Tudge and Scrimsher, 2003). Considering their nature and purpose, Web 2.0 applications are ideal mediators for creating social environments conducive to social learning (Gunawardena, et al., 2009) and helping to achieve social presence (Dunlap and Lowenthal, 2009). With these applications, social engagement critical to learning is extended beyond the cultural perspectives of a local community to groups that are diverse and geographically dispersed, such as groups of learners in online learning environments. Social learning enhanced by Web 2.0 applications is likely to increase motivation (Pauschenwein and Sfiri, 2010) and create relatedness and a sense of community (Wright, 2010) among learners.

Microblogging is one of the latest Web 2.0 applications and can best be exemplified by the highly popular Twitter application (Ebner, et al., 2010). Like blogging, microblogging allows for personal publication and conversation between writers and readers. One unique key feature of microblogging is the short-and-sweet constraint it poses—the limited number of characters per entry. Twitter, for example, allows for only 140 characters per post. This prevents long-winded entries and forces microbloggers to post concise messages. While this format of publication may not allow for in-depth composition in any single entry, the lightweight requirement and mechanism make it easier for people to follow up on conversations and give immediate feedback (Ebner, et al., 2010) because individuals do not need to put in too much time and effort at once. The short messages are very similar to exchanges of real-time text chat on Instant Messenger. However, Twitter does not impose time pressure on the conversant on either end for responding or turn-taking because it does not require synchronous presence. Participants in microblogging only get involved when they feel like it. In addition, microblogging applications allow users to easily share resources such as hyperlinks to web-based multimedia, including images or videos.

In some educational contexts, microblogging has been used for back-channel chat to enhance the communication between the presenter and audience. For example, Elavsky, Mislan and Elavsky (2011) studied students using Twitter for in-class feedback and asking questions during lectures with large audiences (approximately 240 students in their study), where the customary method of asking questions by raising hands could have interrupted the flow of the class. Although Elavsky et al. found that students' class participation and enthusiasm improved, about 47% of the students did not actively use Twitter (posting one or no tweets) for class activities. While this type of microblogging activity helps improve class dynamics, it does not exploit the full potential for social learning because it mainly encourages instructor-to-student communication and lacks peer-to-peer interaction.

In other educational situations, microblogging was used as a social networking tool to promote social interaction and community building. Wright (2010) studied how microblogging helped education students develop self-reflective practices during their practicum. As the participants in Wright's study were required to regularly record and share their thoughts about their teaching practices using Twitter, they reported that they valued the constant contact within the community that was built using the microblogging (i.e., Twitter) because the interaction mitigated their feelings of isolation. Also, Waller (2010) incorporated Twitter to help struggling writers (primary school students) communicate their thinking to each other. It was found that students enjoyed writing and felt excited because they had a real audience that included not only their classmates but also other followers beyond the class.

From the learning perspective, microblogging fosters intellectual exchanges among students or between students and the instructor, through asking questions, giving feedback, exchanging ideas, sharing resources, and reflecting on learning (Ebner and Maurer, 2008). Examining college students using microblogging for project-oriented communication, Ebner et al. (2010) found that this tool supported informal learning and social interaction during group work. They also found that microblogging enhanced process-oriented learning because learners were able to help shape each other's developing ideas through posting thoughts and information pieces.

Microblogging applications have recently become available on mobile devices, and users can benefit from the mobility, computing power, and connectivity of mobile devices during microblogging. This availability, therefore, takes learning through microblogging to the next level—mobile social learning. Namely, social learning can now go with learners truly anytime, anywhere, and with ease. This enables both social learning and learning in authentic contexts that learners create, share, and communicate in real time. For example, learners who find good examples (e.g., photos) related to their learning can create a "sample" through the camera on their mobile devices, share it with peers through Twitter, and communicate their thoughts with short messages. Mobile social learning thus provides an environment where users can build an authentic learning context for their collaborative knowledge construction. The use of mobile social learning has opened up promising opportunities for social interactions, especially for learners in online learning environments who rely heavily on technology for communication.

Research Purpose and Questions

This study investigated the impact of mobile microblogging on students' participation in authentic learning. The following research questions guided this study:

- What kind of interactions are students engaged in when participating in mobile microblogging activities? Are the tweets more about designated coursework or social conversation? What kinds of social conversation would students be engaged in?
- How do students benefit from learning that is situated in authentic contexts and enabled by mobile microblogging?

Through this study, the authors aim to (a) provide useful design suggestions for educators to incorporate mobile microblogging in online learning in meaningful and engaging ways, and (b) explore challenges in design and implementation in order to inform instructional design decisions.

Methods

Study Context

This study was implemented in a fully online graduate course in instructional message design in a mid-size state university in the northwestern United States. This online course was hosted on the Moodle learning management system (LMS) provided by Moodlerooms, Inc. The goal of the course was to have students learn to apply learning and design theories and principles in order to select, combine, and design visuals to effectively communicate instructional information. With emphasis on instructional message design, students in class learned about visual graphic design principles and created graphics for instructional use in their own professional settings. The 16 students enrolled in this course included K-12 teachers, school technology specialists, military personnel, and corporate trainers. Students in this course were required to have smartphones or mobile devices with Internet and camera capability. With the mobile learning component being funded by a university grant (i.e., mLearning scholars), students had the option of purchasing a subsidized mobile device (i.e., the fourth-generation iPod Touch) if they did not have one or needed one for this course.

The Mobile Microblogging Activities in This Study

The mobile microblogging activities, lasting for nine weeks, were designed to help students leverage the potential of mobile computing and the Web 2.0 application Twitter during their learning. The goal of the activities was to extend students' learning context from the content in class to their authentic real-life settings. Each week, each student was required to post at least one original tweet with one graphic design example collected from his/her environment and to comment on the collected design examples. The students were encouraged to share examples related to each week's design topic, such as typography, color, or shape. Also, they were asked to reply to at least two peers' course-related tweets each week. In the activities, students took advantage of mobile device capabilities, documented design examples from their daily-life contexts using the on-device camera, concisely commented on design examples, and shared those examples with the class via Twitter mobile apps. In both original and response tweets, the students were instructed to include a hashtag followed by a designated course-related keyword so their tweets could be searched and located on Twitter by their peers.

The activities were designed to help students become more observant designers by having them consciously attend to potential graphic design examples in their daily lives and evaluate which design techniques/principles they learned in class applied to those examples. This allowed students to reciprocally connect in-class and out-of-class learning and fostered learning in individuals' authentic contexts (e.g., design examples from a gas station on how to use gas pumps, emergency evacuation instruction) through interaction among peers via mobile microblogging. Students could also obtain inspiration for their own design work through the examples collected by themselves and their peers. Because the examples were not simply retrieved from the image search on search engines or photo sharing sites but were associated with peers' life experience, they carried contextual meaning associated with their peers in terms of time, place, and people, which could arguably be more lasting in one's learning experience.

Data Sources and Analysis

This study applied a mixed-method design. The tweets collected from students' microblogging activities were the major data source in this study. Students' tweets were analyzed using a qualitative method first, through open coding and constant comparison. The tweets were first imported into a spreadsheet and coded as original postings and replies. Students' retweets (i.e., tweets reposted from other resources) were not included in analysis since they were neither original tweets nor replies to peers' tweets. Strauss and Corbin's (1990) constant comparison method was then applied in data analysis in this study. With open coding, the authors developed coding schemes to examine the types of tweets. After open coding, the authors constantly compared the data and revised the categories based on the themes emerging from the data through continuous meaning negotiation. After coding and categorizing the tweets, quantitative analysis was applied to help reveal the extent of distribution of different types of tweets in our data set.

In addition to students' tweets, we conducted an online survey on students' perceptions about the mobile microblogging activities at the conclusion of the activities. The questions included the following:

1. Does the microblogging (Twitter) activity help you feel more involved in class as part of a learning community? Why or why not?
2. What do you like most about the microblogging (Twitter) learning activity in this course?
3. What do you dislike most about the microblogging (Twitter) learning activity in this course?

We also asked questions about students' Twitter experience before the mobile microblogging activities, such as whether they had used Twitter and, if so, which types of devices they had used to access Twitter. At the end of the activities, students provided information about the devices they used to share and discuss the design examples in this course.

Results and Discussions

Participants, Mobile Devices, and Time on Microblogging

Ten of the 16 enrolled students participated in this study. Before the microblogging activities in this class, four of the ten students had never used Twitter before. Among the six students who had used Twitter, four of them used smartphones to access or post on Twitter, one used a tablet computer, and one used a desktop computer. At the end of the microblogging activities, seven students were using their smartphones, two used iPod Touches, and one used a tablet. The tweet data of two participants were excluded from analysis because one of them participated minimally, with four original tweets and no replies, and the other removed her Twitter page altogether after this course. While students' time on collecting design examples could vary because finding the examples was incidental, we found that they did not spend much time during any of the nine weeks on microblogging. For each week, two students reported they each spent half an hour, three students each 10 minutes, and the other five students each less than 10 minutes on course-related Twitter activities. Regarding the frequency of checking Twitter, one student checked once a day, two students checked five times a week, three students checked three times a week, and the other four checked fewer than three times a week.

Tweet Analysis

During the nine weeks of activities, each student was required to post a minimum of nine original assignment-relevant tweets and 18 replies. On average, each of the eight students participating in this study posted 14 original tweets (see Category 1 in Table 11.1) and 28 replies (see Category 2 and Category 4 in Table 11.1). The average numbers of both original tweets and replies were 56% more than the required numbers. It is likely that the 140-character constraint makes posting tweets less overwhelming, and therefore participants were more willing to access the mobile devices for microblogging. It is also possible that the easy access and always-on connectivity of their mobile devices made it possible for students to check and reply often.

Table 11.1 Tweet Coding Category and Description

Category number	Coding category	Description
1	Assignment-relevant original tweets	Including tweets directly relevant to the assigned task of posting and commenting on one's own design example collected from his/her daily environment
2	Assignment-relevant replies	Including tweets relevant to the assigned task of replying to peers' posted design examples
3	Other course-relevant tweets	Including tweets on resources sharing; seeking help on Twitter usage (e.g., how to tag tweets or use tags for filtering); responding to other coursework questions; and reflection on learning

Table 11.1 (Continued)

Category number	Coding category	Description
4	Social tweets derived from assignment	Including replies on assignment regarding daily-life experience rather than graphic design aspects
5	Social tweets not derived from coursework	Including tweets that did not originate from the assigned microblogging task but were rather general greetings among class members
6	Resource-sharing tweets after the course ended	Sharing course-relevant resources

We collected and analyzed a total of 361 tweets posted by the eight participants. During our data analysis, we found and defined the following six coding categories emerging from the tweet data. The coding categories and descriptions of the categories are summarized in Table 11.1 above.

Categories 1, 2 and 4, which contained 330 tweets (91% of all analyzed tweets), were related to the assigned microblogging tasks regarding collecting and sharing design examples. Figure 11. 1 below provided a graphical summary of tweet distribution by category.

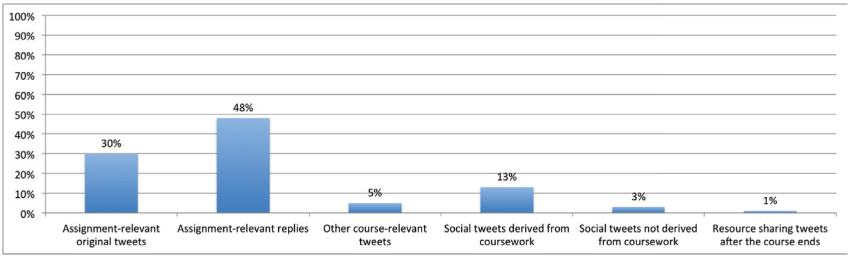

Figure 11.1 Tweet Distribution by Category

In the following section, we discuss the different types of tweets in more detail and provide examples of these tweets.

1. Assignment-relevant original tweets (110 tweets; 30% of all tweets). This category includes the tweets that consisted of links to design example images found in authentic environments and documented by students, with concise comments on the contexts and design aspects of the images. For example, one student commented on a poster: "White space? No, black space, but same concept. I liked the balance on the page provided by the openness."

Another student posted about a commercial delivery package of a movie renting service: "color and depth, good contrast, drop shadow gives pop to the word."

As Figure 11.2 illustrates, one student shared a design example spotted by his daughter at a fast food restaurant. This figure shows the student posting this example and concisely commenting on the design principles (CARP—contrast, alignment, repetition and proximity) being incorporated. This tweet showed another interesting aspect of this activity—some students often involved their family in their learning because it occurred in authentic family contexts, which also revealed the potential of mobile devices for learning in authentic settings. In this particular example, social learning has also been extended beyond the class because it involved interaction among family members, making it even more relevant and motivating.

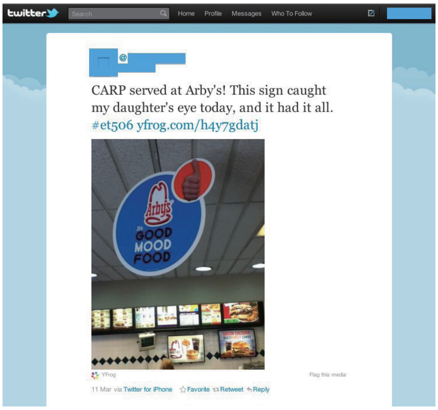

Figure 11.2 A Tweet with a Design Example and Concise Comment on Its Context and Design Principles

Most students were very active in this category and went beyond (56% more) what was required in terms of the numbers of postings. In examining the content of these tweets, we found that students, as observant learners, were able to use relevant design principles and terms to analyze and critique design examples found in their authentic contexts.

2. Assignment-relevant replies (173 tweets; 48% of all tweets). This category includes replies on the design aspects of the examples posted by peers. For instance, one student commented on the design technique of a peer's example: "they probably just bend the words along a path. That would be my best guess. Perhaps it[']s more sophisticated than that?"

Another student provided rationale for agreeing on the negative aspects of a design example: "Agreed. Too much motion. Not enough contrast w/centered text on dark shape."

From the tweets quoted here, we found that although there is a conservative character limit per tweet, students did a good job of concisely analyzing design technique and critiquing examples using technical terms that they learned in this course.

The tweets included in Categories 1 and 2 provide examples of how learners can co-construct graphic design knowledge/ideas through intellectual exchanges during social interactions via microblogging. It is worth noting that the students were very motivated to post more than 50% of the required number of tweets in both categories—they co-constructed knowledge with each other through active original postings and replies. These types of tweets also showed that students engaged in conversation that extended beyond their coursework and was at the same time situated in their real-life experience. Authentic graphic design ideas and examples were found in the social and cultural contexts surrounding the learners.

3. Other course-relevant tweets (18 tweets; 5% of all tweets). This category includes various tweets other than those related to sharing and commenting on design examples. One student shared a web resource featuring online pedagogy useful in general instructional design. Another student used Twitter to offer peers some tips about Twitter usage. Yet another student was inclined to seek help on Twitter usage on such questions as how to tag tweets or use tags for filtering tweets. An interesting use of tweeting in this category was to reflect on one's changes and learning during the course. One student asked his peers: "do [yo]u find [yo]urself looking at signs & designs differently since class began?"

Another student had a similar observation and stated, "It's really funny how this class has changed my perspective of the simplistic things like an instrument panel in a car."

These types of tweets seemed to indicate the Twitter environment could provide a casual atmosphere where students felt comfortable and willing to share the changes in their own learning and expose gaps in their knowledge.

4. Social tweets derived from assignment (47 tweets; 13% of all tweets). This category included tweets about how students related their own personal life experiences to peers' design examples. For instance, one student asked another student about his cooking plan after reviewing the design example of a seafood package. The student being asked responded, "Sorry, no grilling tonight. Was at Whole Foods and thought the fish would make a good background for the graphic."

On a graphic design example of gas pump instruction, one student commented: "Everyone assumes pumping gas can be figured out by all. My wife is from NJ. No self-serve there. She had no clue how to."

This conversation was then joined by a tweet from another student: "I'm pretty sure in Oregon, they pump gas for you... That threw me for a loop when driving thru..."

The tweets in Category 4 showed that seeking real-life experience enabled students to bring their daily lives into their course discussions, which was conducive to sparking social exchange among the members in the community. These social exchanges, while not solely focusing on the content of this course, helped build connections among members and made them relate to each other through sharing experiences regarding various aspects of their lives. In accordance with Gunawardena et al. (2009), the microblogging platform, a type of Web 2.0 application, served as an ideal mediator to create an environment for learning and developing graphic design knowledge and principles socially.

5. Social tweets not derived from coursework (11 tweets; 3% of all tweets). Some students simply connected with other students through compliments, greetings, or discussing the weather and the economy, without referring to any coursework. For example: "...like your user name!" or "Not a fan of drizzly and cloudy anymore. I like the sun. How's the economy doing there these days?"

This type of social tweet was not as common in this course, and 91% of these tweets came from one student. Comparing the distribution of tweets in Categories 4 and 5, it seems the students were usually more engaged in assignment-relevant social tweets.

6. Resource-sharing tweets after the course ended (2 tweets; 1% of all tweets). Only one student posted this type of tweet, where he shared a Twitter mobile app with the instructor. This type of activity is not common. It could have to do with the student's interest in using Twitter as a social tool, as reflected through his continuous updates on Twitter. At the time of our in-depth tweet analysis (four months after this course), two of the eight participants still updated their Twitter postings for personal use.

While the instructor intended to have students focus on discussing design aspects of the shared examples via Twitter, the instruction did not specifically prompt students to do so because the instructor wanted to observe the spontaneous relative contributions of learning tweets versus social tweets. Of all 220 coursework-relevant replies (i.e., Categories 2 and 4), 79% were learning tweets and 21% were social tweets. The distribution of types of tweets seemed to reveal a major emphasis on learning aspects accompanied by a certain level of social bonding. This is likely due to the assignment being situated in the students' daily lives, which meant they could relate to their peers' examples if they had encountered similar life experiences or design examples. The convenience of accessing Twitter apps on mobile devices and the nature of short messaging on Twitter also allowed for quick posting without needing to extensively compose a message, which made it easier to connect with peers in a casual way.

While the instructor hoped that students would focus on design issues during their microblogging activities, social interaction during microblogging was not discouraged because social activities could be vital "glue" in helping students connect with each other and become more engaged in the activities—students could feel more bonded at a personal and social level. The spontaneous social interactions found in the tweets (e.g., mentioning personal dining plans or a wife's hometown) suggest that some students were able to identify with the community and found this microblogging a trusting environment in that they were willing to share their personal information or events with the learning community to build interpersonal relationships.

Benefits of Learning in Authentic Contexts with Mobile Microblogging

1. Promoting learning in authentic contexts. The data collected from the survey showed that students enjoyed mobile microblogging activities that helped connect learning with peers' everyday lives. One student commented that "It provides an opportunity to seek out examples of content in the real world, and it is unique to one person because of the spread out nature of the students in the class (all over the world!). It is exciting to share findings with the class and comment on others' finds".

One student commented on becoming conscious of design principles applied to things in the environment: "I liked the way that it made me aware of all of the things that I read about being applied in everyday life. Examples of design that may have gone unnoticed by me were caught."

2. Reinforcing formal learning with informal learning. Students also found that the activities helped them with course-relevant learning. For example: "I did appreciate learning how to use Twitter, and I do like seeing a few examples of graphics since some helped to generate ideas for my own projects."

Sharing images provided a means to ground some of the textbook concepts as well as others' understanding of those concepts.

3. Enhancing social learning. In addition, students liked Twitter as a tool for social learning: "The class did feel a bit more like a community after starting this activity", "it's more of an informal way to connect with your fellow colleagues".

Overall, the students showed positive attitudes toward the mobile microblogging activities. They found mobile microblogging helped them learn about design examples that were authentic in individuals' contexts and widely geographically dispersed. The students also found that the activities helped them see how the design principles learned in class were actually applied to the design artifacts in their environments. In addition, they learned from peers' views about design and could connect with peers in an informal way.

Instructional Design Implication and Challenges

Our exploration of the different categories of tweets can help inform designing and planning of mobile microblogging for learning in authentic contexts. Instructors can consider the types of tweets (e.g., replies on design aspects or life experiences) they want to solicit and engage students in, and design instructions or prompts that help lead to outcomes aligned with their instructional objectives. The character limit of microblogging may enable a unique mode of communication. While students who prefer extended comments in single postings could find it inconvenient, the lightweight nature of microblogging eases the pressure of extended participation. Despite the character limit, microblogging can help to bring about deep conversation through short but frequent exchanges. While participants might not be able to make a complete argument in one posting, microblogging is likely to promote the opportunity for co-construction of knowledge when participants take turns in elaborating or adding to others' short postings to make their own points clearer.

Implementing a program involving mobile microblogging activities requires early planning and communication. While students' participation and engagement in our mobile microblogging activities exceeded course requirements and instructor expectations, it was not without challenges. In terms of logistics, the instructor had to ensure that everyone in class had access to a mobile device with a camera feature so they could participate in the required tasks. It took some planning in advance to survey students' mobile device accessibility either before or early in the course. Fortunately, most students in this study (i.e., graduate students who are working professionals) owned a smartphone or at least planned to get one by the beginning of the activities. Students who did not have such mobile devices could purchase a subsidized device with the help of the first author's grant funding. If this type of resource were not available, it might be difficult to get all of one's students ready for such activities. In fact, we found that some students were not interested in purchasing the device even with the funding support. In this situation, instructors would want to make sure they could develop alternative activities so that students' learning opportunities were not compromised. In our situation, there was another section of the same course, so the instructor could arrange microblogging activities that did not require mobile devices with the camera feature. In situations where another section of the same course is not available, instructors might have to create two sets of instructions and accommodate two different learning groups in one course.

One student commented on the nuisance of having to remember to include a required hashtag-keyword combination (for searching and filtering) in posting tweets. While there is instructional and learning value in using tags for learning activities, this requirement further reduced the content posting quota because the keyword counted toward the character limit per tweet on Twitter. If learners engaged in conversation with peers, they would also need to include "@username" so the tweets could be directed to the conversant, which further reduces the amount of substantive content one can post in one tweet. Educators interested in incorporating Twitter in their instruction might want to consider these constraints during their planning. It might help to assign a shorter activity keyword or encourage students to create shorter usernames to allow more room for posting in each tweet.

Conclusion

In this study, we showed how to promote learning in authentic contexts through mobile microblogging. The affordances (i.e., mobility, computing power, and connectivity) of today's mobile devices and microblogging applications combined to make students' learning in authentic contexts possible. We found that the students in our study appropriately applied the design principles and terms they learned in class when they critiqued the examples collected by themselves and their peers. Students were able to co-construct knowledge through their exchange of tweets. Generally, they had positive perceptions toward the mobile microblogging activities that allowed them to apply their knowledge about graphic design principles in authentic contexts. The students also indicated that the design examples shared by their peers via mobile apps inspired their design work. While being effective in supporting learning, mobile microblogging was also efficient in helping students connect with each other through short and quick social conversations. We hope the study presented here represents a promising example of integrating mobile microblogging in an online graduate course, one that could encourage educators to explore and experiment with the potential of mobile microblogging for promoting learning in authentic contexts and through social learning.

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12

Mobile Learning in K-12 in Alberta, Canada

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Abstract

Mobile learning has become a term with many meanings within many contexts. For the purposes of this chapter, mobile learning in a K-12 context represents the opportunity for change within the public education system Alberta, from traditional pedagogies of exclusion to one which embraces inclusive practice for all students. The implication of such fundamental change has equal significance for teachers and pedagogy. Mobile learning within a blended learning environment can assist this process and in so doing affect significant change to teaching practice and student learning.

Introduction

Mobile learning can be defined within a variety of social and geopolitical contexts, which are time dependent and ever-changing. The continuous improvement in technology, and the increasing ubiquity of mobile devices, is conducive to an environment that supports anywhere, anytime learning. Whereas mobile technologies have the potential to provide a basic level of service for those areas of the developing world where access to education is minimal or non-existent, these same technologies have the added potential of enhancing existing educational supports and services in the so-called developed world, where access to education is a right. The utility for this new technology is no different than that of the chalkboard, or the ballpoint pen. As a source of technology, mobile devices are useful only to the extent that they assist in facilitating the learning process. However, just having mobile devices is not enough. Thirty years of standalone computer labs in North American schools has demonstrated that, simply handing out technological devices in schools is no guarantee that teaching practices will change.

Two universal themes have emerged in recent years which, if given serious consideration by governments and educational institutions, may provide the necessary contexts for legitimate mobile learning practices. UNESCO is examining the value of mobile technologies in creating universal educational access, equity and quality; and, the extent to which these technologies can support the fundamental changes to instructional design and teaching practice, to meet the needs of today's learners (West, 2012). It is with these two considerations in mind that m-learning within an Alberta context will be reviewed.

The Alberta Context

Alberta has a well established reputation, both as a global innovator in education and as a world leader in educational reform. Albertans have had the good fortune of living in a province rich in natural resources, where investment in education has been a priority. Education and educational technology in particular has been a very important component of this investment. Unlike students in the developing world, Alberta students have had access to computer technology since the early 1980s, albeit, mostly in the form of standalone computer labs used primarily as word processors, with limited access to the Internet. Since that time, despite the significant changes in technology, very little change has occurred in pedagogy and instructional design at the classroom level to incorporate the new technology.

Part of the issue is that technology was initially introduced without a clear understanding of its utility or its potential. For a time, it seemed that just having the technology was sufficient. The norm was to utilize the technology to accommodate existing teacher practice and pedagogical beliefs. Changes to pedagogy were minimal. Computers on teachers' desks were used to maintain student data, and for email. Instructional practice was teacher-directed and content-driven. High degrees of accountability and summative assessment practices in the form of provincial achievement tests in grades 3, 6 and 9, along with provincial diploma exams in grade 12, encouraged teaching practices which were teacher directed with a strong focus on content for the purpose of preparing students for the mandated summative evaluations.

Today, standalone labs are being replaced with portable wireless labs. Students are attending school with personal portable mobile devices, with or without school permission. Ubiquitous social networking is a reality. Social networking practices are providing opportunities for educators to engage students in inclusive learning environments, wherein the design of the learning environment mandates a degree of student autonomy that is usually absent in traditional classroom settings. Mobile learning environments, under the guidance of the right teacher, have the potential to foster the necessary degree of “distance” required by students to ensure the six dimensions of freedom associated with twenty-first century learning: access, content, media, pace, space and time (Paulsen, 1993). The flexibility of ubiquitous engagement has implications for education in Alberta, for the K-12 system and the post-secondary system. By implication, the interconnected nature of both systems and the importance of student bridging and transitioning, establishes the need for partnerships and collective educational planning processes that encompass the life of the learner.

Blended Learning Environments

Mobile learning within the context of the K-12 education system in Alberta implies blended learning environments. The term “blended learning” for the purpose of this chapter will be defined as a combination of traditional classroom processes and online or virtual learning processes. Online learning by design is learner and process focused and requires student-to-student interaction and student-to-teacher interaction (Greener, 2008). The operative term that defines such a learning environment is flexibility. A flexible learning environment is one that can function within the traditional classroom setting, and incorporate an online or virtual component. If properly implemented blended learning can accommodate singular learning processes as well as interactive, interdisciplinary collaborative learning processes, both online and in the regular classroom setting. A blended learning environment may be one that allows the student the flexibility to access education in several learning environments. This may include but is not confined to regular classroom instruction, synchronous and asynchronous online platforms such as Moodle, Elluminate, and adobe connect, as well as video-conferencing and formatted online learning environments that support heterogeneous and homogeneous learning contexts.

Setting the Direction

Two events of significance have shaped the future of public education in Alberta, and in so doing may also have implications for mobile and blended learning. The first was the “Setting the Direction” initiative, launched in 2008 to create a new framework for special education in grades one through twelve. The initiative was initially designed to consider the needs of special education students across the province of Alberta. The design was changed when, after a process of dialogue with more than 6,000 Albertans in 40 consultations, it was revealed that the focus needed to change, to one of acknowledging diversity and celebrating differences within the context of a "inclusive framework". The framework acknowledges that all students have specific learning needs, and that differences should be deemphasized and diversity acknowledged, as stipulated in Article 26 of the *Universal Declaration of Human Rights* (1948), which states that everyone is entitled to an appropriate education regardless of gender, race, color, or religion, without distinction of sex, language, political opinion, national or social origin, property, birth or other status. The inclusion of all students in regular schools is reflective of the international movement to provide equal opportunities and access for all learners in the same schools whenever possible (Forlin, et al., 2011; Katz, 2012). An inclusive philosophy amongst governments and educators focuses on welcoming and supporting the diversity of all children in a given community, within a socially just education system (Ainscow and Sandill, 2010).

The "Setting the Direction" framework recommended the development of an inclusive framework that supports the needs of all students. Inclusive education acknowledges the needs and the rights of the individual learner and is premised on the philosophical belief that all students belong; all students must feel valued, welcomed and respected as individuals and members of an educational community. Inclusion as a global philosophy is one which focuses on the education of every student.

In 2012, UNESCO stated that as a guiding principle, inclusion has underlying implications for teachers' practices and attitudes. Alberta teachers' knowledge, attitudes, and beliefs regarding inclusive education are still variable (Kern, 2006). Ally (2009) states that mobile learning promotes inclusive education options for all students everywhere. The significance of this cannot be understated when considering the importance of partnerships, and the development of best practices on a global scale. Within the teaching profession in Alberta there is neither a clear understanding of the meaning of inclusive education, nor an understanding of the types of practices and supports that need to exist within such a system at the provincial, regional and local levels. Egbo (2009) states "teaching in context of student diversity requires critical self-analysis about beliefs and efficacy, which is crucial for praxis. Introspection can help teachers develop an inclusive theory of practice and insights that can engender change" (Egbo, 2009, p. 126).

As such, an evaluation of teachers' attitudes, beliefs, and perceptions regarding inclusion, is central to developing and promoting an inclusive school culture, because teachers are the key implementers of inclusive practices within the learning environment (Kern, 2006). The literature indicates that overall, teachers believe in the concept of inclusion, but feel they lack the supports needed to effectively carry it out (Katz, 2012; Porter, 2008). Positive attitudes towards inclusion are amongst the strongest predictors of the success of inclusive reforms (Avramidis and Norwich, 2002; Forlin, 2010; Hwang and Evans, 2011; Mastopieri and Scruggs, 2007).

Inspiring Education

The second event of significance was the release, in April 2010, of an Alberta government appointed steering committee report entitled "Inspiring Education: A Dialogue with Albertans". The findings were significant in that they not only set the direction for the future of education in Alberta, but they also highlighted the importance of the student within the educational process. To achieve the goals of twenty-first century learning in Alberta, the following seven principles were identified as significant in shaping the future of education in the province.

- Education should be learner-centered: decision-makers should consider the needs of children and youth first and foremost when making decisions.
- Responsibility and accountability for education should be shared: acknowledging that parents are the primary guides and decision-makers for children. All partners in education should share responsibility and accountability for education outcomes.
- Education implies the entire community: community resources should be fully engaged to support learners, including expertise, facilities, services and learning opportunities. Community resources, whether local, provincial, national or global, should actively participate in the education of learners.
- Education implies inclusive, equitable access for all: every learner should have fair and reasonable access to educational opportunities regardless of ability, economic circumstance, location, or cultural background. Their needs and ways of life should be respected and valued within an inclusive learning environment. Some learners will require additional specialized supports to fully access these opportunities.
- Pedagogy and instructional design should be flexible and responsive to students' needs: children and youth should have meaningful learning opportunities appropriate for each learner's developmental stage, including learning that is experiential, multidisciplinary, community-based, and self-paced. To ensure the learning opportunities are relevant,

the education system must be nimble in responding to the changing needs of communities and the world.
- Recourses should be developed that are both sustainable and efficient: decision-makers should identify and adopt strategies and structures that optimize resources (financial and human) and minimize duplication.
- Changes in practice should reflect a commitment to innovation to promote and strive for excellence: creativity and innovation are central to achieving excellence in education. Learners, educators and governors must be creative, innovative and entrepreneurial to attain the highest possible standards (Alberta Education, 2010).

In order to prepare the children of today for the world of tomorrow, an informed transformation of the public education system is required. The immediate priorities within the vision of the "Inspiring Education" document have been articulated, but have not yet been fully implemented. They are:

- the creation of a new policy framework and governance structure that articulates and embeds the vision of inspiring education;
- the implementation of a competency-based system of education;
- a review of assessment practices and assessment design, to align with a competency-based system;
- the development of a process of continuous evaluation to ensure the system is achieving the desired outcomes.

An Inclusive Design for Mobile Learning

Within the context of what has become a paradigm shift in educational philosophy in Alberta, there is optimism and hope for the future, as the mandates of "Inspiring Education" and "Setting the Direction" realize their goals, to move away from traditional teacher-centered, content-focused practices to more constructivist, inclusive practices. The shift away from the traditional pedagogy of the one size fits all models to that of a more inclusive learning environment will take time. The structures of accountability and traditional pedagogy will change over time. What is important to note is that although changes in pedagogy will take time, the concept of inclusivity, which acknowledges the rights of the individual learner, has already begun to affect change in teacher practice at every grade level from K-12. Change in education is not something that happens quickly. Unless the prerequisite foundational belief statements are incorporated within the system, change is slow to happen. In Alberta today, those foundational belief statements are in place, and as such the changes in practice will come.

Students as a collective, bring a plethora of complexity and diversity to the learning context. Students as individuals bring a unique complexity to the learning context, consisting of a complex blend of diverse strengths, challenges, backgrounds, and experiences. Meeting these individual diverse needs is the mandate of public education and the responsibility of the community as a whole, of which the student, the parent and the teacher are key players. In 2012, UNESCO stated that as a guiding principle, inclusion has underlying implications for teachers' practices and attitudes.

The province of Alberta is not alone in mandating and implementing inclusive educational practices in schools. "Successful inclusion requires persistence and innovation to sustain the effort and to develop approaches to meet the new challenges that emerge over time." (Porter, 2008, p. 64) Alberta teachers' knowledge, attitudes, and beliefs regarding inclusive education are still variable (Kern, 2006). Within the teaching profession, gaps still exist in understanding the meaning of inclusive education, as well as the types of practices and supports that need to exist within the province, school division, and schools.

The Transition to Mobile Learning

We accept the fact that students learn at different rates, yet we insist that all students learn the same things, at the same time and at the same rate. If we allow students to personalize the learning environment, and learn at different rates, we must change the learning environment. This can be accomplished by holding the achievement constant and allowing the time for each student to vary (Reigeluth and Carr-Chellman, 2009, p. 14). Allowing such inclusive practice is synchronous with the mandate of Alberta Education. Furthermore, such a paradigm shift from a standardized time-based learning paradigm to that of a customized attainment based paradigm requires the establishment of two conditions, "... the development of advanced technologies and the advancement of learner-centered psychological principles and methods of instruction" (Reigeluth and Carr-Chellman, 2009, p. 14).

The province of Alberta is in a position to accommodate these conditions. The foundation is in place. What is required is the political will to affect the necessary changes to teacher education programs. This can be done by providing active support for mobile learning within blended learning environments, using mobile devices within and outside the classroom. The use of mobile technology can promote constructivist pedagogy, shifting the focus of the teacher from that of purveyor of content to facilitator of learning. Perhaps the greatest challenge for the Alberta K-12 system in the foreseeable future is the need to change traditional teaching practices from top-down, content-driven instructional approaches to more student-centered process-oriented practices that promote principles of constructivism. Such fundamental change cannot be mandated. Rather, it should be modeled, through pilots and research projects that focus on the issues that challenge the status quo such as: What is the role of the teacher in an inclusive educational environment? Can the use of mobile devices facilitate constructivist practices within a blended learning environment? What is the significance of transactional distance, and to what extent does it promote self-directed independent learning practice?

The challenge is to demonstrate to those teachers who define instruction as the transmission of knowledge, that mobile learning within a blended learning environment promotes learning as a co-construction of knowledge. Transactional distance, cited as the distance factor, is created when the learning shifts from face to face, to online, thereby creating a distance between the student and the teacher. Research shows that the separation promotes independent study, shared responsibility of the teaching/learning experience, with the independence of the learner seen as the most important and desired outcome. This is accomplished through a process of collaborative engagement between teacher and student (Deschênes and Maltais, 2006). A mobile learning environment can comfortably support the fundamental tenet of constructivism which stipulates that, "... people can only learn by constructing their own knowledge; that learning requires active manipulation of the material to be learned and cannot occur passively." (Reigeluth and Carr-Chellman, 2009, P. 6)

Conclusion

The ability to provide learning which is not bound by constraints of time and space, and which accommodates the needs of the learner is not an unreasonable expectation, given the technology at our disposal. The implications for both distance education and traditional classroom instruction need to be investigated. The debate as to which of the two is superior is not an argument intended to improve educational practices, but rather one designed to focus on the territorial imperative of control within the educational marketplace. The possibility of anywhere, anytime learning is significant for instructional design in that not only can learning be inclusive, but also, learning dimensions can be multiple and blended. The challenge for leadership in higher education is to create a culture that acknowledges the potential of all of these processes, for the benefit of the student. This will not be realized without a commitment to the establishment of long term partnerships and collaborations which focus on the learning life of the student.

The leadership philosophy of distance education cannot be one dimensional, nor can it adhere to any one model of leadership. As traditional teaching and learning practices continue to shift away from teacher-centered, content-focused pedagogies to more inclusive student-centered teaching practices, so too will there be a shift towards the importance of program development through partnerships, the issues of intellectual property, the development and continuity of new synchronous and asynchronous infrastructures designed to provide online services, the implications for changes in teaching practice, curriculum development and instructional design, not to mention the challenges of leadership practice implicit in such fundamental change (Beaudoin, 2004, p. 10).

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13

Trailblazing Through a Steeper Path: A Snapshot of Teachers' Explorations in Mobile Learning Implementation in Hawaii's Public Schools

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Abstract

Hawaii is unique in that it is the only state in the United States that has a single, centralized public school system for all students. However, the vision for educational technology and technology integration plans vary greatly from school to school. This study aimed to report a snapshot of the current state of mobile learning in Hawaii's public schools through the perspective of ten in-service teachers who participated in a four-month-long online teacher professional development course titled "Mobile Apps in Education". The teachers explored the possibilities in mobile learning in class and ways to create effective 21st century learning environments. Our findings revealed that within the context of infusing innovation in a public school system, the integration of mobile learning appeared to follow similar patterns with the adoption of emerging technology for classroom use. Teachers' enthusiasm for implementing mobile learning was somewhat diffused by the lack of equipment funding, inadequate and inconsistent policy on purchasing and using mobile devices, and the lack of technical and training support for teachers and students. As with previous early adopters of innovation however, these teachers were determined to meet the challenges of taking a steeper path to implementing mobile learning, often through self-funded and self-supported means. Their early success in implementing lessons using mobile apps has bolstered their eagerness to be school change agents and participate in a small but growing learning community of mobile learning advocates.

Introduction

Over the past decade, we have begun to see widespread integration of innovative technologies such as interactive whiteboards and tablet computers in schools across the globe, and more K-12 schools have taken advantage of the ubiquitous presence of mobile technology (Johnson, et al., 2011). The driving force for the technology integration in the U.S. K-12 schools comes from the rapidly changing world, where students are expected to reach a new level of literacy, also known as *21st century literacy*, which includes technology fluency (21st Century Workforce Commission, 2000). However, simply being able to use technology is no longer sufficient, and today's students need to be able to use technology to analyze, learn, explore, and contribute to the learning of others (International Society for Technology in Education, 2011). In order to create a learning environment that supports 21st century learners, a growing number of K-12 schools have launched mobile learning trials in the past few years, and many implementation reports indicated high levels of success relating to student achievement (Morelock, 2010; Project Tomorrow, 2010; Wells, 2010).

Teachers have been under increasing pressure to meet the needs and expectations of 21st century learners by making fundamental shifts in what to teach and how to teach in classrooms (Bybee and Loucks-Horsley, 2000; Garet, et al., 2001) and also by creating effective learning environments with technology (Groff and Mouza, 2008). While teachers are "necessarily at the center of the reform in 21st century" (Garet, et al., 2001, p. 916), simply implementing new educational policies and standards in schools does not directly change teachers' behaviors or improve students' learning (Bybee and Loucks-Horsley, 2000; King, 2002). In order to make sustainable changes in classroom teaching practice, it is crucial to have powerful mechanisms where teachers can form new beliefs, develop new knowledge, and master new skills (Desimone, 2009; Hew and Brush, 2006; Keengwe, et al., 2008).

Over the past decade, a considerable body of literature has emerged in the area of impact study of teacher Professional Development (PD) (Desimone, 2009; Fishman, et al., 2003), and a general consensus has been built based on the findings that a carefully designed teacher PD is more likely to improve teachers' knowledge, classroom instruction, and ultimately students' learning. It is within the context of an online teacher PD course that this chapter attempts to report a snapshot of the current state of mobile learning in Hawaii's public schools.

Mobile Apps in Education

Hawaii is the most geographically remote archipelago in the world, with the nearest landmass more than 2,000 miles away. The ocean both connects and separates Hawaii from the rest of the world. Even within the state, which is comprised mainly of eight principal islands, there is a relatively high degree of local isolation. To contend with the isolation and inequalities between highly populated Oahu and the more rural neighbor islands and also between poor and rich, the Hawaii State Department of Education (HIDOE) serves as a unitary statewide public education authority. Although the HIDOE is a single centralized public school system for the entire state, the only state in the Union to do this, the vision for educational technology and technology integration plans vary greatly from school to school.

In the HIDOE's effort to advance technology education in Hawaii, the HIDOE teachers are given opportunities to receive pay raises by taking teacher PD courses. Similar to schools in other states, a growing number of HIDOE schools encourage teachers to explore mobile devices in classrooms and create effective 21st century learning environments. Our on-going collaboration with the HIDOE is to provide PD opportunities dedicated to mobile learning to those teachers who are at the early stage of mobile technology. Due to popular demand, the HIDOE offered its first online teacher PD course titled "Mobile Apps in Education" in fall 2011.

This four-month online teacher PD course is comprised of five components listed below, with the aims to help teachers gain knowledge and skills in using mobile devices and mobile apps, and to promote an advancement of the level of mobile technology integration in teaching practice.

- Part I: Mobile Learning Journey (Module 1)
- Part II: Mobile Apps Search and Evaluation (Modules 2 and 3)
- Part III: Mobile Learning Design (Module 4)
- Part IV: Implementation and Reflection (Modules 5.1-5.2)
- Part V: Mobile Learning Moving Forward (Module 5.3)

From July 2011 to October 2011, 17 HIDOE teachers participated in the PD activities online. Teachers performed the following tasks: (a) search for mobile apps, (b) create evaluation rubrics for apps, (c) annotate online resources for lesson ideas, (d) examine their school environment for technology innovation, (e) create three apps-integrated lesson plans, (f) implement one of the three lessons, (g) collect student work samples, and (h) reflect on the implementation. After each module, teachers were asked to reflect on their learning. For the analysis in this study, we used participants' work for the assignments in modules “3 Locus of Control Assessment”, “5.1 Implementation and Student Samples”, “5.2 Reflection on Implementation”, and “5.3 Where Do I Go from Here?”

In addition to the teachers’ production, we also administered an online survey prior to the PD course, in order to gather information about the study participants’ background. The pre-module survey included 52 multiple-choice questions and 4 open-ended questions. All the qualitative feedback, including teachers’ reflections and responses to the open-ended questions in the survey, was analyzed using thematic coding techniques. Authors of this chapter examined, discussed, and agreed upon each response and whether it fell in one code or another. Codes were then assigned to specific characteristics in each textual statement, which enabled the authors to quantify the responses.

Participants

Demographic

Of the seventeen teachers who attended the HIDOE’s online teacher PD course, ten gave consent to be part of this study. These ten teachers were from the three islands of Hawaii, though mostly from Oahu (n=8). All but one were female, and five of them were in their 30s. They were highly educated with 7 of them holding a master’s degree in their subject or related area, and six of them were teaching at the elementary school level. The average total years of teaching was around 12 years; all of them have taught at least 5 years and one teacher has taught more than 20 years. Table 13.1 shows the summary of the participants’ demographics and background information.

Table 13.1 Participants’ Demographic and Background Information

Demographic Variable	Number of Respondent
Gender	
Male	1
Female	9
Age	
21-30	2
31-40	5
41-50	1
51 >	2

Table 13.1 (Continued)

Demographic Variable	Number of Respondent
Grade level teaching	
Elementary	6
Middle school	1
High school	2
SPED resource teacher (all level)	1
Content focus	
Elementary	5
Social studies	2
SPED	2
Science	1
Island of resident	
Oahu	8
Hawaii	1
Kauai	1

Prior Mobile Technology Competence

According to the pre-module survey data, the participants' competency level in technology use ranged from being intermediate to being advanced. All ten participants agreed that they were comfortable with and confident in using technology in general, and nine of them agreed that they could solve technical issues on their own. In addition, all of them had integrated technological tools in their classrooms before such as desktop computers and Netbooks. As for their mobile technology competence, all the participants owned mobile devices for personal use prior to the online teacher PD course, suggesting that they had some knowledge about and experience in the use of mobile device and mobile apps. Half of the participants were confident of using mobile technology as they agreed that it would be easy for them to get mobile technology to do what they need it to do in class.

As for the mobile technology use in classrooms, most participants felt that they were receiving adequate technology and administrative support service from their school. In fact, the majority of the participants agreed that their administrator supported innovative use of technology in school (*n*=9) and that they had mobile learning devices available to them in class (*n*=7). In addition, more than half of the participant (*n*=6) claimed to be an active user of mobile devices for an educational purpose, and three teachers had colleagues who were actively integrating mobile technology in their curriculum. Although the teachers' perceptions on technology and administrative support for mobile learning from their school was positive before the online teacher PD course, their own evaluation of their locus of control as well as their reflection on their own learning at the end of the online PD course told us a slightly different story. Table 13.2 below summarizes the pre-module survey results concerning the participants' technology competency and their perceptions on technology and administrative support from their school.

Table 13.2 Participants' Technology Competency and Self-Reported Administrative Support

Major Category	Mean Value (1: Strongly Disagree, 5: Strongly Agree)
General Technical Skills	4.30
Mobile Technology Use for Educational Purpose	3.98
Administrative Support	3.70

Mobile-Integrated Lessons

Implementation

One of the major course assignments in this online PD course was for teachers to develop three mobile-app-integrated lesson plans, and then implement one of the plans in class. Table 13.3 lists the ten lessons implemented by the teachers, apps used, and a short description of each lesson activity.

Table 13.3 Ten Lessons Implemented by the Participants

Lesson Title	Grade Level	Content Area	Mobile Apps Used	Description
Tracing is Fun!	K	Language Arts	Alphabet Tracing	Students practice recognizing their letters, writing their letters, sounding out the letters (in upper and lower case) using the iPad app "Alphabet Tracing" and will create their own Alphabet book
Starfall ABC's	K	Language Arts	Starfall ABCs	In 3-4 20-minute sessions, students work one-on-one with this app. For each alphabet, students listen to the sound and see how to write it with animation, and to differentiate upper and lower cases

Table 13.3 (Continued)

Lesson Title	Grade Level	Content Area	Mobile Apps Used	Description
Word Families	1st	Language Arts	Screen Chomp	"Screen Chomp" is like personal whiteboard with audio recording ability. From a base word given (e.g., *an*), students add letters to form new words. Then students record pronouncing these new words using the app
Multisensory Language Practice	1st SPED	Language Arts	Multisensory	Students will be allowed to use the mobile device for 5 minutes at the beginning of class to trace the lower case letters with proper stroke order. Then they will be shown the picture/sound cards, and they will say the letter name and trace the letter (on their desks, or in the air), say the key word (picture), and then give the letter sound
The Life Cycle of Plant	2nd	Language Arts and Science	Pages	Students document the life cycle of a plant from seed to death with photos. Using a mobile device, students take photos of the pot every day and use a ruler to show the height of the plant. Students use the "Pages" mobile app to insert pictures and create their observation document
Photo of the Day	2nd	Language Arts	Photo of the Day	Using the "Photo of the Day" app, students pick a photo. Each student creates a short story from the point of view of one of the people or animals in the picture they choose
Multiplication Speed Drills	4th	Math	Flash to Pass and ChartPad	Working individually, students use the "Flash to Pass" app to practice. Then students use the app "ChartPad" to enter score data into the table. At the end of the week, students analyze their graph and write a reflection to include the range of their scores, the median and mode (if any). Students also interpret their results by writing a statement about their overall progress

Table 13.3 (Continued)

Lesson Title	Grade Level	Content Area	Mobile Apps Used	Description
Brainpops and Quizzicles	8th	U.S. History	Brainpops	"Brainpop" mobile app provides educational cartoon videos, activities, timelines, and quizzes on a multitude of topics. As a whole class, watch the short video on the three branches of government on "Brainpops". Based on the videos, in pairs, students complete the "matching" and "graphic organizer" activities
Age of Exploration Flashcards	9th	Social Studies	Flashcard+	Given a list of explorers and information websites, students conduct internet research. Students report their findings using the "Flashcard+" app by creating their own card deck
WordPress	10th–12th	Science	WordPress	Picking 50 vocabularies among 100, students take a picture representing each of the term. Use the "WordPress" mobile app, students will submit their pictures to the class blog

Overall, it was apparent that the teachers resorted to what they already knew and felt comfortable doing. They were doing the same activities as usual, just now on a different device, for instance, using "Pages" for presentation or watching a video as a whole class activity. Features of a mobile device were not fully taken advantage of, except for a couple cases where the camera was used. The fact that students could perform multiple tasks on a single device that traditionally would have involved several devices, cables, and transferring files to a laptop, exemplified an important, while small affordance of mobile learning. In our case study, it was our intent to focus on teachers' willingness to give mobile learning a try and learn from the experience. Changes in classroom teaching practice happen slowly. Within the safe environment of the online PD course designed especially for the HIDOE teachers, the participants were willing to take the first steps. These first-attempts should be accepted and encouraged for future endeavor within their locus on control.

Reflection on Implementation

As part of the course assignment, teachers were asked to reflect on their implementation session and write a report. The reflection reports indicated that all the participants successfully executed their mobile-app-integrated lesson and had positive experiences from the implementation session. In the report, when describing their students, the teachers frequently used such words as “engaged”, “focused”, “excited”, “motivated” suggesting that the implementation session had positive influences on student learning. Furthermore, when asked if there were any unexpected events that occurred during the implementation session, five teachers reported pleasant surprises such as students being engaged more than they expected or finding the apps working better with more diversity of students than they originally thought.

The most exciting part of the implementation process reported by the teachers was to actually see improvements in their students' learning and behaviors (*n*=10). For example, one teacher commented that the assignment completion rate was much higher compared to the normal classes which didn't use any mobile apps. Other teachers also reported that students were thoroughly engaged in materials that they might have normally been less excited to participate in, and the teachers were very excited to see normally reluctant readers wanting to read and struggling writers wanting to write using the mobile devices and mobile apps. The data also showed that such improvements in students' learning and behaviors might have had a positive influence on student achievement. One teacher reported that her students' assessment scores were greater in numbers between before and after the implementation session. This suggested the positive changes in students' attitudes towards learning led to better performance.

At the same time, however, more than half of the teachers (*n*=6) commented that not having as many mobile devices for the entire class was the most frustrating part of the implementation process. Furthermore, some of them had a hard time implementing their lesson plan not only due to lack of mobile devices (*n*=2) but also due to lack of technology support from school for both teachers and students (*n*=3). The comments below showed the participants' frustration during the implementation process:

“I could only do one or two students at a time—it would be very nice to get the whole class engaged at the same time.”

“Not having enough iPad/iPod to get all the children really involved in using mobile apps.”

Although some students owned mobile devices that could have been used during the implementation session, the teachers claimed that the school restrictions prohibited them from using their personal mobile devices in class.

While the improvements in students' behaviors during the implementation session were frequently mentioned in the report, some setbacks were also reported. Among 12 comments provided as unexpected outcomes, 7 were negative surprises. In one case, the mobile devices became a distraction to students due to advertisement that came with free apps. In addition, there were a few students who did not like working with a mobile device and wanted to use a regular computer and mouse. Table 13.4 summarizes the participants' reflection report data.

Table 13.4 Summary of the Participants' Reflection on Their Implementation Session

Question Statement	Responses	Count
What was the most exciting part of the implementation?	• Improvement on students' work/product	4
	• Improvement on students' engagement and focus	3
	• Improvement on students' motivation	3
What was the most frustrating part of the implementation?	• Not having enough devices for all students to use	6
	• Not having funds	2
	• Time management	2
What would you do differently?	• Modify activities and allotment of time	6
	• Get more funding	3
Anything that was unexpected?	• Pleasant surprise	5
	• Unpleasant surprise	7

Suggestions for Future Implementation

When we asked the teachers what they would suggest to other teachers who were about to introduce mobile technology in their classrooms, the following three themes emerged from their responses: (a) getting teachers ready for mobile learning integration (*n*=7), (b) getting the school ready for mobile learning (*n*=5), and (c) getting students ready for mobile learning (*n*=3).

The results supported the previous studies that just having innovative technology in class does not directly change teachers' behaviors or improve students' learning (Bybee and Loucks-Horsley, 2000; King, 2002). The three themes clearly indicated that, for mobile learning to be successful, the school system, teachers, and students, all need to be ready for diverse learning environments that support digital-age learning experiences. Table 13.5 shows the participants' responses by theme and with selected quotes.

Table 13.5 Summary of the Suggestions for Other Teachers

Category	Responses
Prepare teacher	• Sign up for a class like this • Download, practice and run through the apps before actual implementation
Prepare schools	• It would be helpful if there were on-going support system in place • Make sure you have access to an iPad
Prepare students	• Make sure the students know how to use an iPad • Maybe have a lesson on the use of iPad

Discussion

From July 2011 to October 2011, seventeen teachers local to Hawaii, were given the opportunity to participate in a four-month online teacher PD course titled "Mobile Apps in Education." Through the course activities, the teachers explored possibilities in mobile learning in their class and ways to create effective 21st century learning environments. We hope to see a new change curve occurring as these teachers brought back what they learned from this online teacher PD course to their school. While we do see similar patterns with the adoption of emerging technology for classroom use, mobile learning seems to be moving forward at a higher speed. The findings of this case study should be regarded in this context. A few themes emerged that represent a snapshot of the beginning stage of mobile learning integration, in Hawaii's public schools.

Although the HIDOE is a single centralized public school system, the data clearly indicated that the vision for educational technology and technology integration plans vary greatly from school to school. Many teachers reported that there was no clear policy on the use of mobile device and mobile apps in their school, and no clear professional development was in place specific for mobile learning. Although most schools seemed to support innovative use of technology in classrooms, the teachers' attempt seemed to be constrained by lack of funding, inadequate mobile technology policy, and lack of mobile technology training opportunities for both teachers and students. The teachers were doing what they could within their locus of control. In other words, they were the trailblazers, trying out mobile learning on their own, using their own mobile devices and funds, and raising support through their own networks. In this context, the HIDOE's on-going effort to work with the university professionals and provide teachers with quality teacher PD opportunities focusing on mobile technology deserved special attention.

The four-month online PD course, “Mobile Apps in Education”, provided the ten teachers with basic knowledge and hands-on with mobile technology. Such experience encouraged their further exploration into mobile technology and enabled them to see the potential of mobile learning. Although most of the study participants were active users of mobile technology for recreation, they were still at entry-level in mobile technology integration in class. While most of them were unable to take full advantage of features of mobile technology, given that they had just begun to experiment with new tools and strategies in such a restrictive environment, their effort in successfully implementing their own app-integrated lesson plans was a major accomplishment. Furthermore, at the completion of the course, all teachers showed an increased commitment to mobile learning and indicated their eagerness to be school change agents by continuing to search for educational apps, sharing what they learned from this online teacher PD course by creating learning communities, and demonstrating the effectiveness of the mobile technology to administration. They commented that all these steps would help them get more buy-in and eventually lead to more funding to purchase mobile devices and obtain necessary training for both teachers and students.

Conclusion

The study helped us observe the occurrence of teachers’ professional growth. Before attending the online PD course, many of the participants were skeptical about the state of mobile learning in their school and even had positive perceptions about technology and administrative support from their school. However, the knowledge and the experiences gained from the PD course enabled them to see the potential as well as the challenges that they will be facing as the level of mobile technology integration advances. Overall, the results indicated that this online teacher PD course was effective in making positive changes in teachers’ attitude and perceptions about mobile learning in their schools and should by all means repeated in the future.

As a self-selected group, these teachers were already interested in exploring mobile learning. Furthermore, a for-credit course provided the motivation, structure, and learning community for these teachers. Nevertheless, it is also important to continue monitoring their integration level in class and providing them with additional PD classes as necessary. It is our intent to follow up with these ten study participants and investigate further impact of the PD course on classroom teaching practice and on student learning. At the same time, we also plan on designing another online teacher PD course for those HIDOE teachers who are at the intermediate level of technology integration. In that course, the focus will be on mobile pedagogy for learners in the 21st century. The intent is for teachers to see more examples, explore different ways of designing learning, and to connect and learn in a safe environment. As the only nationally accredited teacher preparation institution in the state of Hawaii, University of Hawaii is tasked not only to produce teachers for the HIDOE, but also to increase satisfaction and retention of motivated HIDOE teachers. It is our hope that carefully designed teacher PD course like this one makes sustainable changes in classroom teaching practice, and ultimately improve student learning.

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Using Self-Efficacy to Assess the Readiness of Nursing Educators and Students for Mobile Learning[1]

Richard F. Kenny et al.[2]

Abstract

The purpose of this study was to assess the self-efficacy of nursing faculty and students related to their potential use of mobile technology and to ask what implications this technology has for their teaching and learning in practice education contexts. We used a cross-sectional survey design involving students and faculty in two nursing education programs in a western Canadian college. In January 2011, 121 faculty members and students completed the survey. Results showed a high level of ownership and use of mobile devices among our respondents. The median mobile self-efficacy score was 75 on a scale of 100, indicating that both faculty and students were highly confident in their use of mobile technologies and prepared to engage in mobile learning.

Introduction

Previously, we (Kenny, et al., 2009a, 2009b; Park, et al., 2010) argued that mobile learning (m-learning) could be effective to support the teaching and learning of nursing students at a distance. We subscribe to Koole's definition (Koole, 2009; Koole, McQuilkin and Ally, 2010) of m-learning: It is a process resulting from the interaction of mobile technologies, human learning capacities, and the social aspects of learning. In the nursing education context,

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m-learning supports more situated, experiential, and contextualized learning and affords the use of up-to-date and accurate information (Kukulska-Hulme and Traxler, 2005). Particularly in nursing practice education (clinical courses), m-learning has the potential to bring instructors, peers, and resources together virtually at the point-of-care to support students' safety and evidence-informed practice (Park, et al., 2010).

The purpose of this study was to gauge nursing faculty and students' current use of mobile devices in their teaching and learning and to measure their mobile self-efficacy as an indicator of their readiness to engage in m-learning in the future. As such, this is a replication, on a larger scale, of a previous study (Kenny, et al., 2010). As before, we were interested in our respondents' level of motivation to engage in m-learning and, specifically, in the concept of self-efficacy (Bandura, 1997) as applied to mobile learning in nursing education.

Self-efficacy refers to the personal beliefs individuals have that they are capable of learning and performing particular behaviors and is domain-specific (Bandura, 1997; Schunk, 2008). Students' perceptions of self-efficacy have been found to influence their decisions about the choice of activity in which they engage, their emotional responses (e.g., stress and anxiety) when performing the behaviors, and their persistence in carrying out these actions (Bandura, 1997; Compeau and Higgins, 1995; Schunk, 2008). In the m-learning domain, mobile use is both enabled and constrained by the physical and functional components of the specific devices. They are the medium through which learners interact and therefore impact their physical and psychological comfort levels (Koole, 2009). These components directly impact device usability and therefore an individual's ability to use her mobile device to engage in cognitive tasks, locate and manipulate information, and communicate and collaborate using social technologies (e.g., text messaging, email, or audio conferencing). In an m-learning context, these applications allow learners to interact in social and learning communities where they can acquire information and negotiate meaning. The ensemble of these components then defines the m-learning process and domain.

Individuals' self-efficacy judgments differ on three interrelated dimensions: magnitude, strength, and generalizability (Bandura, 1997, 2006; Compeau and Higgins, 1995). Magnitude refers to the level of task difficulty individuals believe they can attain. Those with high mobile self-efficacy would believe they were able to use their mobiles to accomplish difficult and sophisticated tasks, while those with low mobile self-efficacy would think they were only able to use them for limited and simple tasks. Self-efficacy strength refers to the level of confidence individuals have in their ability to perform specific tasks (e.g., their level of confidence in their ability to easily learn and use the various features of, and applications provided by, mobile devices). Finally, self-efficacy generalizability reflects how much an individual's judgment is limited to a particular domain of activity. Individuals with high mobile self-efficacy generalizability expect to be able to competently use a variety of different devices, while those with low computer self-efficacy generalizability may perceive their capabilities as limited to particular devices, especially those with which they have had experience.

While a significant body of research exists on learners' feelings of self-efficacy concerning computer technology, online learning, and even podcasting (e.g., Compeau and Higgins,1995; Hodges, et al., 2008; Johnson, 2005; Kao and Tsai, 2009; Koh and Frick, 2009; Liang and Wu, 2010; Loftus, 2009), this concept does not appear to have been examined in any detail in a mobile learning context.

Method

This study then replicates and extends our previous research (Kenny, et al., 2010) to gauge the current use of mobile devices by nursing faculty and students in their teaching and learning and to assess their readiness to engage in m-learning by measuring their mobile self-efficacy. Our research questions were as follows:

- In what ways are faculty and students currently using personal mobile devices in their teaching and learning?
- How do they foresee using personal mobile devices in teaching and learning in the future?
- To what degree is the level of mobile self-efficacy of nursing faculty and students related to their potential use of m-technology in teaching and learning?

To investigate these questions, we used a cross-sectional survey design involving students and faculty in two separate nursing education programs at a community college in western Canada: a one-year Practical Nurse (PN) program and a four-year Bachelor of Science in Nursing (BSN) program. At the time of the survey, there were 55 students and 9 faculty members in the PN program and 134 students and 18 faculty members in the BSN Program, for a total of 216 potential participants.

We used an online survey to gather demographic information and mobile use data (see Appendix A) and to administer the mobile use self-efficacy questionnaire (see Appendix B). The demographics and mobile use questions were both quantitative and qualitative in nature. Questions 3 to 6 afforded respondents the opportunity to provide open-ended written comments in addition to the scaled items, while questions 7 to 9 asked only for open-ended responses.

Bandura (1997, 2006) stresses that self-efficacy should measure judgments of capability that may vary across specific realms of activity. Our mobile self-efficacy questionnaire was based on a computer self-efficacy instrument (Compeau and Higgins, 1995) modified for a mobile learning context. This consisted of changing the question stem for students from "I could complete the job using the software package ..." to "If I had a mobile device such as a smartphone or 3G phone (e.g., iPhone), I could use it in my Nursing program ..." For instance, the wording for students in question 1 was, "If I had a mobile device such as a smartphone or 3G phone (e.g., iPhone), I could use it in my Nursing instruction if there was no one around to tell me what to do as I go." See Appendix A for the full set of questions. Bandura describes the assessment of self-efficacy as follows:

> In the standard methodology for measuring self-efficacy beliefs, individuals are presented with items portraying different levels of task demands, and they rate the strength of their belief in their ability to execute the requisite activities. They record the strength of their efficacy beliefs on a 100-point scale, ranging in 10-unit intervals from 0 ("Cannot do"); through intermediate degrees of assurance, 50 ("Moderately certain can do"); to complete assurance, 100 ("Highly certain can do"). (Bandura, 2006, p. 312)

As stipulated by Bandura, we asked our respondents to express their confidence about mobile use behavior by answering 10 questions, each rated from 0 to 10. If their answer was "No" ("Could not do"), they selected "0". If their answer was "Yes", they chose between 1 and 10, with "1" indicating only slight confidence and "10" showing total confidence ("Highly certain could do"). Therefore, the scale ranges from a minimum of 0 to a maximum of 100. Nursing students and instructors scoring 0 believe that they are essentially incapable of learning and using mobile devices in their teaching and learning, and those scoring 100 believe they are highly certain of their ability to learn and use mobile devices for this purpose. Bandura (2006) also stresses the need for item homogeneity within a domain-relevant scale. Cronbach's alpha was 0.941, indicating that the mobile version of the scale could be considered strongly internally consistent.

Factor Analysis

An exploratory factor analysis was also conducted to see if the mobile self-efficacy questions as modified for this study might be grouped together and, if so, in what way. An oblique rotation was chosen to ensure that only the unique relationship between each factor and observed item was included in the model. The resulting pattern matrix yielded two factors with eigenvalues greater than 0.7 (ranging from 6.65 to 0.92) and before the scree plot flat-lined (see Table 14.1). The two factors were "external resources" and "using the mobile device alone"; they accounted for over three-quarters of variance in the measure (75.64%). These factors can be interpreted as aspects of our participants' perceived strength of self-efficacy about mobile device use in their teaching and learning. Both reflect their self-confidence in the use of the various feature applications provided by their mobile devices. However, it is reasonable to assume that participants might feel more self-confident if they received some support in their learning from others or external sources on their devices, rather than relying solely on themselves.

Table 14.1 Pattern Matrix of Mobile Self-Efficacy Item

Item	*If I had a mobile device such as a smartphone or 3G phone(e.g., iPhone), I could use it in my Nursing instruction...*	Factorloading: External resources available	Factorloading: Using mobile by self
9	if someone showed me how to do it first.	1.006	
7	if I had a lot of time to complete the task for which the device was provided.	0.949	
10	if I had used similar devices before this one to do the same task.	0.879	
6	if someone else had helped me get started.	0.874	
5	if I could call someone for help if I got stuck.	0.666	
4	if I had seen someone else using it before trying it myself.	0.660	
8	if I had just the built-in help facility for assistance.	0.599	
1	if there was no one around to tell me what to do as I go.		0.925
2	even if I had never used a device like it before.		0.852
3	if I had only the device manual for reference.		0.669

Factor	Eigenvalues	% of variance	Cumulative %
1	6.649	66.49	66.49
2	0.915	9.15	75.64

Rotation Method: Oblimin with Kaiser Normalization.

Results

Demographic Information

In January 2011, 121 faculty members and students completed the survey for an overall response rate of 56%. Table 14.2 provides the breakdown of respondents by program type, status as faculty or student, and gender.

Table 14.2 Demographic Information

Factor	Grouping	*N*	%
Program	PN	38	31.4
	BSN	83	68.6
Status	Faculty	17	14.0
	Student	104	86.0
Gender	Male	12	9.9
	Female	109	90.1

The BSN program was much larger than the PN program and provided over two-thirds of the respondents in this study. Ninety percent were female, while slightly fewer than 10% were male.

Table 14.3 Age Data by Program

Status–Year	*N*	Mean	Min.	Max.	Skew
BSN students year 1	23	27.17	19	43	0.800
BSN students year 2	21	24.90	20	50	2.841
BSN students year 3	16	28.69	21	52	1.293
BSN students year 4	11	32.64	22	49	0.779
PN students	33	34.39	19	53	0.092
Regular faculty	14	50.50	43	61	0.331
Sessional faculty	3	41.00	31	50	-0.467
Totals	121	32.49	19	61	0.599

As shown in Table 14.3, PN students were substantially older than the BSN students on average and more uniform in age. The mean ages of the BSN students varied from an average of about 25 in the year 2 group to nearly 33 in the year 4 group. Overall, our student respondents tended to be mature adults.

Mobile Ownership and Use

The familiarity of ownership should impact users' assessments of their capability to use a mobile device and, therefore, mobile self-efficacy scores. Only 10 of our respondents (8%), two faculty members and eight students, indicated that they did not own a mobile device. Table 14.4 shows which mobiles our respondents owned. About 15% owned a classic (phone only) mobile, while 27% had a phone with a camera or MP3 player. 22% possessed a smartphone (e.g., a Blackberry), while 24% had a 3G phone (e.g., an Apple iPhone). Just under 12% had "other" devices (such as an Apple iPod Touch or iPad), which provided them with email, Internet access, and nursing applications.

Table 14.4 Type of Mobile Owned

	Mobile Type					Total
	Classic cell	Cell / camera	Smart-phone	3G phone	Other	
BSN students year 1	7	4	4	7	1	23
BSN students year 2	2	8	8	3	0	21
BSN students year 3	2	6	3	4	1	16
BSN students year 4	0	2	5	3	1	11
PN students	3	10	3	9	8	33
Regular faculty	3	3	4	2	2	14
Sessional faculty	1	0	0	1	1	3
Total	18	33	27	29	14	121

Among students, the types of devices owned were relatively uniform across program groups. 28% of BSN students and 30% of PN students owned a mobile phone with a camera, while 24% of BSN students and 27% of PN students had a 3G phone. Faculty had a lower level of ownership with 11% owning a camera phone and 15% possessing a 3G phone.

To explain their mobile self-efficacy, it was also important to detail how faculty and students used their devices in their daily lives as well as in teaching and learning. Table 14.5 shows which mobile features our respondents used weekly. Not surprisingly, the majority (83%) of respondents used the telephone function of their mobiles the most.

Table 14.5 Mobile Device Features Used at Least Once a Week

Program	Faculty–Student	Telephone	Camera	Email	Browser	SMS	Audio msg.	Word pro.	Health apps.	Games	Other
BSN	Faculty	8	2	6	6	7	0	1	1	1	3
	Student	65	31	28	34	56	4	6	9	20	12
PN	Faculty	4	1	1	1	2	0	0	1	0	1
	Student	24	11	9	13	22	5	4	4	4	2
Totals		101	45	44	54	87	9	11	15	25	18

The number was not 100% because some respondents indicated that they used their mobiles for emergency purposes only, and others may have tended to text more than telephone since text messaging (SMS) was the second most widely used feature at 72%. Just under half (45%) of our respondents used their mobiles weekly to browse the Internet, while over one-third used them for photography (37 %) or email (36%), and 21% to play games. Other uses included recording videos in the lab, listening to music, using the address book, alarm clock, and calendar features, and keeping memos and lists.

We also asked which features respondents used at least once weekly to support their learning or teaching (see Table 14.6), and they reported this use to be about 65% of their total mobile use. 54% used the mobile for educational purposes, while 39% used their devices for browsing and texting, and 30% for email. It was surprising that only 17% of this sample reported using their mobiles for health applications since in our previous research (Kenny, et al., 2009a), nursing students rated drug reference programs as the most useful mobile feature.

Table 14.6 Mobile Features Used in Nursing Education by Program

Program	Faculty–Student	Telephone	Camera	Email	Browser	SMS	Audio msg.	Word pro.	Health apps.	Games	Other
BSN	Faculty	4	0	3	4	4	0	1	1	0	2
	Student	44	12	24	28	32	1	8	11	0	8
PN	Faculty	3	0	1	1	0	0	0	1	0	0
	Student	14	7	8	14	11	3	5	7	2	4
Totals		65	19	36	47	47	4	14	20	2	14

The Potential Use of Mobile Devices in Teaching and Learning

In the demographics section of the survey, we asked our respondents to answer an open-ended question: "What do you see as the potential uses of these technologies to support teaching and learning in the practice area?" They made a wide range of comments about the use of mobile devices in their teaching and learning. The two major themes that emerged from this data were, perhaps not surprisingly, the benefits of and barriers to the use of mobile devices perceived by the faculty and students in both nursing programs.

1. Benefits. One major benefit noted by faculty and students for their teaching and learning was the use of mobile devices to provide quick, easy, and anytime access to current professional information at the point-of-care. This included both the use of nursing resource applications such as drug guides and access to the Internet. This perceived importance of mobiles as a way to access resources is also supported by past research and our own studies (Kenny, et al., 2009a, 2009b). These comments by BSN students typify the comments made in this regard: "Technology can support nursing practice, such as accessing current information quickly to support practice decisions, reducing errors (i.e., using programs to check drugs and calculate doses)."
And, as another student said,

> If downloading is time effective, it can allow for faster access to information without having to track down books or hardcopy resources. The information will be up-to-date. It can be accessed from the patient's bedside for teaching and learning based on specific questions by the patient.

The following comment by a PN student corroborated these views:

> I think they will help because there is so much that technology like phones are capable of nowadays; Websites, questions we may have, being able to talk to somebody somewhere else quickly without leaving the room, I think there is so much potential to it. Faster responses, and if someone does not know the answer, they can find it.

The other main benefit cited by our respondents was the use of mobile devices to improve communications between faculty and students who are off campus on practice placements, thereby affording students greater access to their instructors. In this regard, one instructor noted,

> Mobile devices could provide instant communication with students (i.e., texting/ emails)—texting re- "checking in" with students who are in indirect supervision (i.e., community

> placements)—using blackboard to send messages to students, receive documents from them (i.e., domains of practice)—use of nursing resource software to support myself and students in the practice setting (i.e., medication software, psychomotor skills, nursing assessment)—access best evidence to support practice (i.e., databases to search for information related to practice).

And a BSN student noted that mobile devices could provide "support from teachers, we have two towns primarily that we are sent to for placements, and our instructors may not be immediately available. We could get quick responses and support from them if we had communication on these devices."

2. Barriers. Our respondents also reported on barriers to the use of mobile devices in their teaching and learning. The barriers most widely discussed were the cost of both mobile devices and of wireless connectivity and who should pay for it. For instance, one BSN student stated,

> Not all people have these types of devices—they can be costly with roaming time as well—will VIHA (Vancouver Island Health Authority, which runs the local hospitals and clinics) help in paying these bills? Will everyone be expected to have one?

A PN student made a similar observation:

> As indicated previously, my only concern is the cost associated. I currently do not maximize the potential of my smartphone simply because the fees to do so are a lot, which is not in the budget of a student.

Our respondents also noted potential barriers pertaining to mobile use in the hospitals. One was a concern about infection control. One BSN faculty member commented,

> [I] just wonder about infection control issues with these devices in the clinical setting, I can see this as being an issue, and also wonder if the cleaning products required by the agency would damage the devices.

And a PN student agreed, commenting that,

> The word "sanitary" comes to mind...if using the phone in the nursing practice, we would have to be aware and practice asepsis technique.

Another concern was about current hospital policies related to mobile use. A

BSN faculty member raised this issue as follows:

> Hmmmm...I think we need to inform and educate our colleagues in the agencies about the use of technology, that in fact using a cell phone near a cardiac monitor is not going to upset the monitor, nor will it upset communications, etc., within the hospital particularly. I think this is true, and I think there is a need to assure people that it is not going to get in the way of their practice.

And, finally, while not a benefit or barrier per se, some faculty members discussed the overall need to adjust their teaching to take into account the mobile technology that students are using in their daily lives. For instance, one BSN faculty member stated,

> Students are very comfortable with technology these days, and it is very much the norm at breaks and meal times to see them pull out their phones or mobile device and start to text, and so forth. Many students have pointed out applications to me in these settings which they frequently use to support their learning, such as drug guides or "apps" which quickly remind them of vital sign norms, and so forth. I want to understand them and be able to relate on their level. I want to be able to communicate with them and not appear that I don't know. I also want to maintain a sense of where they are at, and without understanding the technology that they use and how this influences their learning. I would feel somewhat of a disconnect. I am not saying that it surpasses other ways of teaching, but for them it is the new "normal", and I must adjust to it to help support/understand them as well as using other teaching/learning techniques.

The last word in this regard went to a PN student, who also expressed the importance of nurses keeping up with emerging technologies in a rapidly changing world:

> Since we do live in a technology age that is progressing and changing all the time, we need to keep up with it to provide fast and better care for our clients.

Self-Efficacy

The demographics data and analysis of the comments made by our participants indicated that they had adopted mobile technologies in their personal lives and appeared to foresee the potential for their use in teaching and learning. Most of our respondents reported owning a mobile device, and most used it at least weekly to make telephone calls. But did this translate into the confidence to use mobile devices in their professional lives? Did their familiarity with mobile use translate into feelings of self-efficacy?

The average mobile self-efficacy score (see Table 14.7) was 68 out of a possible score of 100. However, these scores were negatively skewed, indicating a tendency toward higher scores with individual low scores affecting the average. Therefore, the median score of 75 is likely more reflective of the group as a whole.

Table 14.7 Self-Efficacy Scores—Program Comparison (Faculty–Student Combined)

Program	*N*	Mean	Median	Std. Dev.	Min.	Max.	Skew
BSN	83	72.16	79.00	24.523	5	100	-1.014
PN	38	58.92	64.50	29.357	0	100	-0.624
Total	121	68.00	75.00	6.734	0	100	-0.898

There was also a substantial difference between programs. BSN students and faculty had a median score over 14 points higher than PN program members (70.00 as opposed to 64.50). An analysis of variance (see Table 14.8) showed the mean self-efficacy scores between programs to be statistically significant at the $a \leqslant 0.05$ level.

Table 14.8 Self-Efficacy (SE) Scores by Program: ANOVA Results

		Sum of squares	d*f*	Mean square	F	Sig.
SE score program	Between groups (combined)	4566.273	1	4566.273	6.692	0.011
	Within groups	81197.727	119	682.334		
	Total	85764.000	120			

Table 14.9 compares the mean mobile self-efficacy scores by faculty and student. The mean student self-efficacy scores were higher than those of the faculty, but

faculty median scores were higher, indicating that the faculty means were likely affected by an outlier. However, an ANOVA showed no statistically significant differences between the self-efficacy scores of these two groups.

Table 14.9 Self-Efficacy Scores: Faculty–Student Comparison

Faculty–Student	*N*	Mean	Median	Std. Dev.	Min.	Max.	Skew
Faculty	17	62.12	80.00	35.173	0	100	-0.635
Student	104	68.96	74.50	25.176	0	100	-0.913
Total	121	68.00	75.00	26.73	0	100	-0.898

A Pearson's r correlation between respondents' chronological ages and self-efficacy scores was 0.145. While this mild negative association indicated that respondents' self-efficacy scores tended to be higher for the lower age groups on average, this relationship was not statistically significant.

However, there was a significant positive relationship between the total number of mobile features respondents reporting using and their self-efficacy scores (see Table 14.10). Pearson's r correlations indicated that those indicating higher numbers of features used tended to also have higher SE scores.

Table 14.10 Number of Mobile Features Use and Self-Efficacy

Total features used weekly by SE	$r = 0.391$	$a \leqslant 0.01$
Total features used in program by SE	$r = 0.368$	$a \leqslant 0.01$

Discussion and Conclusions

M-learning has the potential to bring instructors, peers, and resources together virtually at the point-of-care to support student safety and evidence-informed practice. This study assessed the current use of mobile technology by faculty and students in nursing education and investigated their predisposition to use this new technology in their teaching and learning.

Our first research question asked how faculty and students were currently using personal mobile devices in their teaching and learning. The results of the demographics portion of our survey revealed that most respondents owned mobile devices and that nearly half (46%) owned smartphones or 3G devices. Furthermore, the ownership of these more sophisticated mobiles was spread fairly evenly across all groups and ages. While our respondents used their mobiles weekly and predominantly for communications (cell phone, texting, and email), they also used them regularly for a range of other activities, including Web browsing, photography, word processing, and health applications. More importantly, nearly two-thirds (65%) of the time, our respondents used their mobiles in their teaching and learning. This data alone indicates that our respondents are not only predisposed to use mobile devices in nursing education, they have already begun to do so.

Our second research question queried our respondents about their views on using mobile devices in their teaching and learning in the future. If nursing faculty and students are already using these devices in a substantive way, will this use increase? In what ways? This question was addressed most specifically by our respondents' replies to the open-ended question asking for their views about the potential uses of these technologies to support teaching and learning in the practice area. They pointed out both benefits and barriers to such use. Among the benefits were just-in-time access to current, professional information at the point-of-care and improved communications between students and faculty, especially while students are in clinical practice placements. Among the barriers were the cost of purchasing a device and high wireless connectivity costs as well as issues of infection control and adhering to current hospital policies. The implication of these findings is that, despite some significant barriers to use, nursing faculty and students do foresee an increasing use of mobile devices in their practice and strong reasons for their presence.

Finally, we asked, to what degree is the level of mobile self-efficacy among nursing faculty and students related to their potential use of m-technology in teaching and learning? Self-efficacy refers to individuals' personal beliefs that they are capable of learning and performing particular behaviors. The stronger the sense of personal efficacy they possess, the greater their perseverance will be, and the likelihood increases that they will perform the chosen activity successfully (Bandura, 1997; Compeau and Higgins, 1995). Our results provide some support for this relationship. The mean self-efficacy score for our respondents was 75, a rating that reflects a high level of confidence in their ability to use mobile technology; that is a strong sense of personal mobile self-efficacy. Moreover, there were strong positive correlations between the magnitude of our respondents' use of mobile device features and their self-efficacy scores. While this data is based on self-report scores rather than independent observations, it does provide support for the conclusion that the more individuals (at least as represented by our respondents) use mobile devices, the more self-confidence they develop in use, resulting in the increased likelihood that they will use the devices even more, forming a positive feedback system.

These self-efficacy levels, however, were significantly different between program groups, with BSN students and faculty having a median difference that was 14 points higher than PN students and faculty. Since the PN students engage in a one-year certificate program while the BSN students are involved in a four-year baccalaureate program, it is possible that higher levels of education and experience could contribute strongly to an individual's sense of mobile self-efficacy in learning contexts. No other comparisons resulted in significant differences. There was no discernible difference in mobile self-efficacy between faculty and students. While there was a slight relationship between age and self-efficacy in favor of younger respondents, this correlation was not statistically significant.

Despite the difference between nursing programs, at a median rating of nearly 65 out of 100, even PN students and faculty are demonstrating a strong sense of mobile self-efficacy. While the BSN students and faculty in this institution had a higher level of mobile self-efficacy, the vast majority of our respondents indicated a strong sense of self-confidence in using their mobile devices, and their use of these devices clearly carried over into their teaching and learning.

It appears, then, that nursing faculty and students are quite familiar with the use of mobile technology, and a substantial proportion of them are very comfortable using the various functionalities these devices afford. Therefore, it is reasonable to conclude that nursing students and faculty, as represented by our respondents, are well prepared and strongly motivated to engage in mobile learning. The implication for nursing programs is that there is a substantive reason for them to consider the integration of mobile device use in their curricula, if they have not already done so. Nursing faculty and students are already using such devices in their teaching and learning informally on a regular basis, and this use is only likely to increase.

Future Research

While the results from this study appear to provide strong evidence that nursing students and faculty are well-disposed to m-learning, these results are from two nursing programs in one rural community college and, as such, need to be corroborated in different settings and at different levels of nursing study. Our research team is currently implementing a replication of this study in baccalaureate and graduate specialty nursing programs in a large urban setting in Western Canada.

In addition, while our mobile self-efficacy scale was based on a previously validated computer self-efficacy scale (Compeau and Higgins, 1995) and its validity is also supported by the results of an exploratory factor analysis, the psychometrics of our current instrument require further assessment. We will carry out a confirmatory factor analysis as a component of our planned replication study.

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Appendix A: Demographics and Mobile Use Questions

1. What is your age?
2. What is your gender?
3. Do you own a mobile device? [single choice with comment]
   a. Classic cell phone (telephone only).
   b. Classic cell with digital camera and/or MP3 player.
   c. Smartphone with email and Internet capability (e.g., Blackberry Bold, HP iPAQ 910).
   d. 3G Phone (with visual desktop and access to an applications "store"; e.g., Apple iPhone, Google Android phone).

e. Other (please explain).
f. I don't own a mobile device.

4. If you own a mobile device, which features do you use at least once a week? [multiple choices with comment]
   a. The telephone.
   b. The digital camera.
   c. E-mail.
   d. Internet Browser.
   e. Instant text messaging (SMS).
   f. Audio Messaging (e.g., Skype, MSN Messenger).
   g. Word processing.
   h. Health applications (e.g., ePocrates).
   i. Games.
   j. Other (please explain).
   k. I don't own a mobile device.
5. If you own a mobile device, which features have you used at least one or more times in your Nursing program to support your learning? [multiple choices with comment]
   a. The telephone.
   b. The digital camera.
   c. E-mail.
   d. Internet Browser.
   e. Instant text messaging (SMS).
   f. Audio Messaging (e.g., Skype, MSN Messenger).
   g. Word processing.
   h. Health applications (e.g., ePocrates).
   i. Games.
   j. Other (please explain).
   k. I have never used my mobile device in my Nursing program.
6. Which kinds of information would you like to be able to share with your students or other instructors via mobile? [multiple choices with comment]
   a. Course administration (i.e., meeting times, assignments, absences, etc.).
   b. Motivational messages.
   c. Evaluatory comments.
   d. Care planning decisions.
   e. Sharing practice information.
   f. Sharing interesting Internet links.
   g. Other.
7. What do you see as the potential uses of these technologies to support nursing practice? [open comment]
8. What do you see as the potential uses of these technologies to support

teaching and learning in the practice area? [open comment]

9. Please add any further comments or observations about your use of cell phones and other mobile devices that you would like to bring to our attention. [open comment]

Appendix B: Mobile Self-Efficacy Scale Questions

If I had a mobile device such as a smartphone or 3G phone (e.g., iPhone), I could use it in my Nursing instruction ...

Q1: ...if there was no one around to tell me what to do as I go.

Q2: ...even if I had never used a device like it before.

Q3: ...if I had only the device manual for reference.

Q4: ...if I had seen someone else using it before trying it myself.

Q5: ...if I could call someone for help if I got stuck.

Q6: ...if someone else had helped me get started.

Q7: ...if I had a lot of time to complete the task for which the device was provided.

Q8: ...if I had just the built-in help facility for assistance.

Q9: ...if someone showed me how to do it first.

Q10: ...if I had used similar devices before this one to do the same task.

Epilogue

The current book highlights similar problems, hesitations and mindsets related to the application of mobile learning across the seven reviewed regions of Canada, the USA, Europe, Russia and Ukraine, Latin America, Africa and the Middle East, Asia and the Pacific in **Chapter 1**. Although a new challenging environment for mobile learning immerse worldwide, the adoption rate of mobile learning does not evolve at equally rates to the penetration of mobiles and smartphones. The main reasons for such delay can be grouped in five categories: The first one is insufficient educational policies, which is considered to be the most critical. In many regions there is a gap in the existing regulations describing the use of mobiles in educational environments, or policies already exist are too general with no further specification to the use of mobiles (as they mainly apply to the adoption of new technologies in education). If specific and more updated regulations will be formed by the Ministry of Education of each region having national application (likewise the "Learner Information Model for Mobile Learning" by the Standards Council of Canada), or the set of Common Core State Standards in the USA, they could have a critical and profound positive impact on mobile learning. The existence of such framework of regulations will assist both the local authorities and the educational personnel to adopt and promote mobile learning technologies in everyday life activities.

Apart the above-mentioned category of insufficient educational policies, some other barriers falls in the other four categories of: Hesitating Mindsets (health and psychological issues related to the students or to the users of the mobile devices), Socioeconomic and technology limitations, Lack of human resources (availability of skilled personnel) and Hardware limitations.

Some of these barriers (i.e. the Hardware Limitations) will be easy to overcome, while others (i.e the Hesitating Mindsets or the Lack of human resources) may be remedied in a long term timeframe.

Other voices claim that the role and impact of the research community is becoming marginal as regards mobile learning. According to Traxler in **Chapter 2**, the use of mobiles for learning in international development will contradict and probably ignore local theories of learning, theories embedded in their traditions and their culture and expressing their ideas about what to learn, where, when, why and how to learn, who learn from. Given this cultural diversity in the ecology of learning with mobiles some forms of mobile learning will thrive whilst others will perish.

Elias discussing the universal instructional design principles for Mobile learning in **Chapter 3**, identifies eight principles that have been developed to build flexibility of use into both the instructional design and operating systems of educational materials. These principles refer to equitable and flexible use (i.e simple content format, and in small chunks), simple and intuitive coding, perceptible information, tolerance for error, low physical and technical effort (i.e. use available SMS readers), use large community of learners and multiple support methods and creation of instructional climate.

Under the view of these statements educators will be forced to rethink their current approaches to teaching. They should not look exclusively for the next great technological advance but rather should focus on the accessible design of materials using tools that are currently available and easy to use.

The adoption of principles of universal instructional design will be beneficial not only for the educators but also for organizations that wish to bolster their employees' performance and progress in midst of tough competition using mobile learning technologies. As Amit Garg states in **Chapter 4** "...the best way to get started with mobile learning is to 'just do it' and it is good to start small". For example, an organization can start to initiate a mobile learning endeavor just by sharing some content online and optimizing it for mobile access. According to Garg, it is better to do something rather than do nothing. It is the experience of implementing an initiative that helps to make plans better and bigger. To keep in step with the evolving mobile domain, it is imperative to review the mobile learning initiatives, obtain feedback from learners and their supervisors, look for areas of improvement, identify success that can be replicated elsewhere, and use this information to improve and remedy content in order to close the loop.

In some cases the employment of blended mobile learning approach can further expand learning spaces. The affordances of mobile tools combined with the ubiquitous character of m-learning and the nomadic tendencies of mobile learners open up new territories of knowledge construction. Five conceptual spaces of mobile learning were identified by A. Palalas in **Chapter 5** as the essential elements of the m-learning ecosystem. The ensuing mobile learning topography encompasses the following spaces: (1) temporal, (2) physical, (3) transactional: intrapersonal, personal, and interpersonal (social and public), (4) technological as well as (5) pedagogical. It has also been proposed that the intersection of these spaces results in a unique m-learning space: the optimal m-learning zone.

A powerful aspect of mobile learning is the ability for the learner to interact with multiple types of media as Schroeder advocate in **Chapter 6**. Mobile learning, like all technology, will always be a work in progress. However, mobile learning may mean different things to different people. But it is the devices and applications used that make people mobile and digital. Mobile technologies enable their users to learn anytime, anywhere, continually asking questions and searching for answers. Will this method of learning eventually transform the traditional view of learning? Looking at the shift in learning which is happening as a result of the rise in social media, ubiquitous cloud computing, and new technologies, a MOOC complements all these changes, and mobile learning offers the devices and characteristics to realize them.

The MobiMOOC ran and moderated by Ignatia deWaard—as described in **Chapter 7**—was an example of an open and adaptive, complex system. The technologies used gave rise to emerging phenomena in its activities. Additionally, dialogues were central to knowledge creation within the MobiMOOC. These combinations of factors that characterize MOOCs make them a possible solution in the search for new educational environments that fit the so called "Knowledge Age".

Given the above assumption, mobile learning is considered as one of the most important ways to change learning, impacting technology, pedagogy, human development, and even human freedom. China is a typical example of such change, where the use of mobile devices and network infrastructures are developing at a fast rate, especially in big cities like Beijing and Shanghai as Li Shiliang and Sun Hongtao state in **Chapter 8**. In such promising environment, both teachers and learners in China will be more concerned about adopting new educational approaches which will be currently mobile and network based. It is expected that adaptive designs will be implemented to meet the real needs of learners and the pedagogical issues which will emerge. Furthermore, due to the multipurpose nature of mobile devices, much of the innovation done for these areas can also benefit mobile learning. With the large outsourced manufacturing systems in place, particularly in China, the ability of continued innovation and strong competition will continue as David Topolewski et al. foresee in **Chapter 9**, driving prices down for mobile devices. With the use of proper policies, mobile learning can provide enormous amounts of data—a treasure trove for researchers—to analyze learning inputs, practices, and outcomes. If such data is provided to the research community and not kept proprietary, it will be the catalyst for immeasurable future benefits.

Qing Tan and Nashwa El-Bendary in **Chapter 10** highlight another promising approach of mobile learning, with the employment of location-based mobile learning systems. The 5R adaptive framework and the Augmented Reality integration in location-based mobile learning provide a solution and a standard structure for implementing wider-ranging adaptation for location-based environments for mobile learning. Some leading guidelines for recognizing location-based learning practices and effective pedagogies incorporated in a particular "learning space" with the support of mobile devices are also discussed, aiming to enhance learning in location-based mobile learning environments by taking the factors of learner, location, time, and mobile devices into consideration. This adaptation enables the learning process to be even more flexible and spontaneous than traditional distance learning, affording new opportunities for learner support, content development and delivery providing valuable assistance to learners with disabilities.

In the last chapters of the book, some successful cases of mobile learning initiatives are reported.

In **Chapter 11** Hsu Yu-Chang and Ching Yu-Hui discuss the topic of mobile microblogging, using Twitter and mobile devices in an online course to promote learning in authentic contexts. In their study, they conclude that the students appropriately applied the design principles and terms they learned in class when they critiqued the examples collected by themselves and their peers. Students were able to co-construct knowledge through their exchange of tweets. While being effective in supporting learning, mobile microblogging was also efficient in helping students connect with each other through short and quick social conversations.

Dermod Madden in **Chapter 12**, depicts the mobile learning in K-12 Alberta Canada, provides the possibility of anywhere, anytime learning which is significant for instructional design, as learning can be inclusive as also learning dimensions can be multiple and blended. The challenge for leadership in higher education in Alberta was to create a culture that acknowledges the potential of all of these processes, for the benefit of the student. This will not be realized without a commitment to the establishment of long term partnerships and collaborations which focus on the learning life of the student.

A very interesting study is reported in **Chapter 13** by Lin Meng-Fen Grace, Ritsuko Iyoda, and Curtis P. Ho, where a snapshot of teachers' explorations in mobile learning implementation in Hawaii's Public Schools is discussed. The study helped the authors to observe the occurrence of teachers' professional growth who participated in a four-month-long online teacher Professional

Development course titled "Mobile Apps in Education". Before attending the online PD course, many of the participants were skeptical about the state of mobile learning in their school and even had positive perceptions about technology and administrative support from their school. Overall, the results indicated that this online teacher PD course was effective in making positive changes in teachers' attitude and perceptions about mobile learning in their school and should by all means repeated in the future.

The intent is for teachers to see more examples, explore different ways of designing learning, and to connect and learn in a safe environment. As the only nationally accredited teacher preparation institution in the state of Hawaii, University of Hawaii is tasked not only to produce teachers for the HIDOE, but also to increase satisfaction and retention of motivated HIDOE teachers. It is our hope that carefully designed teacher PD course like this one makes sustainable changes in classroom teaching practice, and ultimately improve student learning.

Another successful initiative comes from Richard F. Kenny et al. in **Chapter 14**, as they use self-efficacy to assess the readiness of nursing educators and students for mobile learning. It appears that nursing faculty and students are quite familiar with the use of mobile technology, and a substantial proportion of them are very comfortable using the various functionalities these devices afford and they are well prepared and strongly motivated to engage in mobile learning. Nursing faculty and students are already using such devices in their teaching and learning informally on a regular basis, and this use is only likely to increase.

One way or another, independently of our support or hesitations, mobile learning has been already "landed" in the social and educational landscapes and it is expected to alter dramatically the way people, students and teachers learn, react, communicate and interact with the educational material and each other.

Professor Avgoustos Tsinakos
Professor Mohamed Ally

October 7, 2013

Glossary of Terms

21st century literacy: "The current and future health of America's 21st Century Economy depends directly on how broadly and deeply Americans reach a new level of literacy that includes strong academic skills, thinking, reasoning, teamwork skills, and proficiency in using technology." (21st Century Workforce Commission, 2000, p.5)

Active learning: A generic term that refers to several models of instruction that focus the responsibility of learning on learners. One could think of this type of learning as being the opposite of "passive" learning, where the teacher is the center of the instructional model.

Adobe Connect: Web-conferencing software that offers many options for live interaction, such as video conferencing, application/screen-sharing, file transfer, text chatting, and presentations.

Android: Open source operating system pioneered by Google and used across a variety of mobile devices.

App:(also called mobile apps, or mobile applications) Software made for mobile devices including any mobile platforms.

Augmented Reality: A concept that provides allowing users to see the real world with virtual objects superimposed upon or composited with the real world.

BYOD: Bring Your Own Device, also known as free of cost projects, where the cost is shifted to the learners who can participate using their own mobile

China Mobile: One of the leading mobile services providers in China. The Group boasts the world's largest mobile network and the world's largest mobile customer base. It holds the largest market share in China.

China Telecom: China Telecommunications Corporation, one of the leading mobile services providers in China. China Telecom built the world biggest CDMA 3G network, with its earliest commercial services in China.

China Unicom: China United Network Communications Group Co., Ltd, one of the leading mobile services providers in China. It was officially established on 6 January 2009 on the basis of the merger of former China Netcom and former China Unicom.

CNNIC: China Internet Network Information Center, which released the

Internet Development Statistics Report regularly in January and July each year since 1998.

Cognitive theory of multimedia learning: A theory of how we learn from words and pictures, based on three main assumptions—there are two separate channels (auditory and visual) for processing information; there is limited channel capacity; and learning is an active process of filtering, selecting, organizing, and integrating information.

Collaborative learning: An educational approach to teaching and learning that involves groups of students working together to solve a problem, complete a task, or create a product.

Constructivist epistemology: Belief that knowledge and reality do not have an objective or absolute value, and we have no way of knowing this reality.

Cross-platform mobile development: It is an attribute conferred to the mobile software or mobile computing methods and concepts that are implemented and inter-operate on multiple mobile platforms.

Data encryption: Data encryption refers to mathematical calculations and algorithmic schemes that transform plaintext into cyphertext, a form that is non-readable to unauthorized parties.

E. W. Scripps: It organizes the state spelling bees within the U.S., which culminates in an international spelling bee where delegations from other countries are invited.

f2f: Face-to-face.

Face Time: Apple software product that allows users to video chat from various Macintosh operating system devices.

Facebook: Social networking service, started in 2004, where users can be updated on "friends" and provide updates on their own activities.

Flash: A multimedia authoring program from Adobe Systems. Flash is popular for creating animation, video and adding rich interactivity to web pages, and is available in most common web browsers.

Flipped classrooms: New concept for education where students spend class time practicing and "homework" is used to introduce the material.

Formal learning: Opposite of informal learning, or learning that is pre-arranged and usually would only occur in an education setting.

Gmail Chat: Google software tool that allows users to text, audio, or video chat in real time.

Google Analytics: Google software tool that provides detailed statistics on website activity and usage.

Google Hangout: Video chat feature included in Google Plus, a social networking service, which allows users to chat in real time.

GPS: The Global Positioning System (GPS) is a satellite navigation system that provides location and time information anywhere on or near the Earth, where there is an unobstructed line of sight to a number of available GPS satellites.

HTML 5: HTML5 is a markup language for structuring and presenting content for the World Wide Web and a core technology of the Internet. It is the fifth revision of the HTML standard.

iCollaborator: An iPhone application for collaborative application for mobile learning environment that was developed at Athabasca University to provide multimedia mobile meeting and interactive virtual whiteboard in which participants can effectively communicate and exchange ideas in a real-time manner with location-aware aspects.

ICT: Information and communication technology.

Informal learning: Opposite of formal learning, or learning that can occur at anytime, anywhere, usually prompted by authentic need.

iOS: Operating system used across all Apple products.

L&D: Learning and Development is the field which is concerned with organizational activity aimed at bettering the performance of individuals and groups in organizational settings.

LBS: Location Based Services, which means two things: The first is to determine the geographic location of the mobile device or user; second is to provide all kinds of information services and location.

Learning management systems: Administrative tools used by teachers in tracking and recording student progress.

Lime Survey: An open source online survey tool. It allows users to quickly create intuitive, powerful, online question-and-answer surveys.

LMS (Learning Management System): An online system that manages the learning process and allows students to interact with the course, other students, and the instructor.

Location-awareness: A feature for devices that can passively or actively determine their location. The term applies to navigating, real-time locating and positioning support with global, regional or local scope.

MAM: Mobile Application Management, which describes software and services that accelerate and simplify the creation of internally developed or "in-house" enterprise mobile applications.

MDM: Mobile Device Management (MDM) software secures, monitors, manages and supports mobile devices deployed across mobile operators, service providers and enterprises.

M-learning: Mobile learning.

Mobile app: A mobile application (or mobile app) is a software application designed to run on smart phones, tablet computers and other mobile devices. They are available through application distribution platforms, which are typically operated by the owner of the mobile operating system, such as the Apple App Store, Google Play, Windows Phone Store or the BlackBerry App World. "App" is an abbreviated form of *application*. It commonly refers to a software program for mobile devices. In January 2011, the American Dialect Society named "app" the word of the year for 2010.

Mobile device: Any portable, hand-held and battery-powered computing device that is compact, lightweight and can be carried anywhere easily. It has an operating system (OS), and can run various types of application software. Some of the examples include smart phones, features phones, tablets, PDAs, laptops (partially mobile).

Mobile learning (M-learning): M-learning is any sort of learning activity, anywhere and at any time, with the learner who is not at a fixed, predetermined location, as well as the learner taking advantage of the learning opportunities offered by mobile technologies. So, it is not only about the mobility of the learner or the device, but also mobility across contexts.

Mobile platforms (or operating systems): A mobile operating system, also referred to as mobile OS, is the operating system that operates a smartphone, tablet, PDA, or other digital mobile devices.

Mobile Virtual Campus (MVC): A collaborative mobile learning group system that has been developed at Athabasca University to provide an innovative and interactive platform for online mobile learners by utilizing the location-awareness and other built-in sensory components in mobile devices.

MOOC (**massive open online course**): An online course aiming at large-scale participation and open access via the web.

Native app: An application designed to run in the computer environment (machine language and OS) it is being run in.

NetEase: One of the biggest Internet service portals in China. Its business involves Email services, search engine and massive multiplayer online gaming, online video, and so on.

OPD: Organization Provided Devices projects, where a university or a province or a company takes the complete responsibility of the project's cost.

Optimal m-learning zone: The most favorable interplay of mobile learning spaces promoting optimal learning.

PC: Personal computer.

Premium SMS: Used in select countries to pay for goods and services via cell phone where the amount is charged to phone bills.

Problem-based learning: Also known as PBL, problem-based learning usually involves the solving of an authentic problem by a group of students, with no “right” or “wrong” answers.

Proliferation of mobiles: The rapid growth of mobile devices (phones or of infrastructures) in a society or a target population.

Qooco: Beijing based EdTech Company committed to mobile learning.

QQ: A popular instant message tool in China. It is a product of Tencent, Inc. which is one of the China’s largest Internet service portals.

Radical constructivism: It views knowledge as being actively received and constructed either through the senses or by way of communication.

Responsive design: Responsive web design (often abbreviated to RWD) is an approach to web design in which a site is crafted to provide an optimal viewing experience—easy reading and navigation with a minimum of resizing, panning, and scrolling—across a wide range of devices (from desktop computer monitors to mobile phones).

RFID: Radio-frequency identification, which is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking.

SCORM: Sharable Content Object Reference Model, which is a collection of standards and specifications for web-based eLearning. It defines communications between client side content and a host system called the run-time environment, which is commonly supported by a learning management system.

SCPD: Shared Cost Provided Devices projects, where the cost of the device or the communication cost is shared among the organization and the learners.

Sina: One of the biggest Internet service portals in China.

Smartphones: Mobile devices that offer more advanced connectivity than mobile or feature phones.

SMS: Stands for “Short Message (or Messaging) Service”, a system that enables users to send and receive text messages.

S-Points: Currency that can only be used in the Samsung App Store, purchasable through ATMs.

Tablet: A tablet computer, or simply tablet, is a one-piece, mobile version of a personal computer, primarily operated by touch screen (the user’s finger essentially functions as the mouse and cursor, removing the need for the physical [i.e., mouse & keyboard] hardware components necessary for a desktop or laptop computer; and, an onscreen, hide-able virtual keyboard is integrated into the display).

Telecom: Telecommunications company, whose services range from landlines to wire grids for cell phones and internet access.

Tin Can API: This is an eLearning software specification that allows learning content and learning systems to speak to each other in a manner that records and tracks all types of formal and informal learning experiences.

Twitter: A very popular instant messaging system that lets a person send brief text messages up to 140 characters in length to a list of followers.

UN Millennium Goals: Goals set in place by the UN with a target date of 2015; dedicated to fighting extreme poverty, illiteracy, HIV/AIDS, etc.

User experience (UX): The way a person feels about using a product, system or service. User experience highlights the experiential, affective, meaningful and valuable aspects of human-computer interaction and product ownership, but it also includes a person's perceptions of the practical aspects such as utility, ease of use and efficiency of the system.

Web app: An application that is accessed over a network such as the Internet or an intranet.

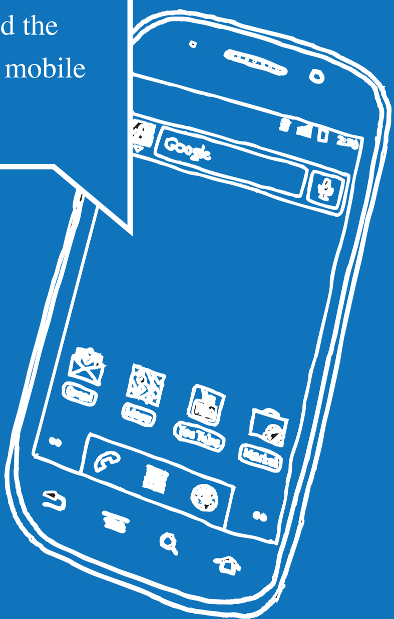
WEIBO: A Twitter-like micro blog social network, which has 56.5% of the Chinese micro-blogging market. It is a product of Sina Corporation.

Worked Examples: A step-by-step demonstration of how to perform a task or how to solve a problem.

Index

Global Mobile Learning Implementations and Trends

The book is edited by two internationally recognized mobile learning experts and the chapter authors are from around the world. They have extensive expertise in mobile learning. The book presents information on implementation of mobile learning around the world and trends in mobile learning. It is a valuable resource for educators and trainers who want to find out about mobile learning around the world and who would like to conduct research on mobile learning.



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