Mobile Technologies in Open Schools

Edited by
Sanjaya Mishra

COMMONWEALTH of LEARNING

MOBILE TECHNOLOGIES IN OPEN SCHOOLS

EDITED BY
SANJAYA MISHRA

The Commonwealth of Learning (COL) is an intergovernmental organisation created by Commonwealth Heads of Government to encourage the development and sharing of open learning and distance education knowledge, resources and technologies.

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PREFACE

This book is encouraging evidence that the open schooling community is planning proactively for its future. Mobile technology — particularly mobile phones — will one day be part of the furniture of open schooling, even though this book found no example of an accredited course being delivered entirely through mobiles today. Surely, however, this criterion for usage sets the bar too high. I am sceptical about the wisdom of using any technology as the sole mechanism for delivering a complete course. Similarly the studies found no evidence that mobile technology improved student performance in tests, although they did find that it reduced dropout and increased completion, which are important accomplishments in distance learning.

The authors report good news and bad news. The positive development is that even as we bewail the inequities of the digital divide, mobile technology is throwing a bridge across it. Only a decade ago the statement 'half the world's people have never made a phone call' was a staple of speeches on international development! Humankind has since taken to mobile phones with an enthusiasm never shown for any previous communications technology. Ownership and use are growing so fast that any figure quoted is immediately out of date; nevertheless it is already true that far more people own mobile phones than have television sets, computers or credit cards.

The bad news is that although mobile phones are ubiquitous in the developing world the high cost of usage requires that educators must use them sparingly until rates come down. According to the ICT Development Index 2009, the percentage of gross national income (GNI) per capita for 25 outgoing calls in predetermined ratios and 30 SMS messages per month varies from 0.1 per cent for top-ranked Singapore, Denmark and Hong Kong to 60.1 per cent for bottom-ranked Togo. In sub-Saharan Africa, mobile costs are more than 20 per cent of the average annual GNI per capita. In contrast, in the developed world, costs are less than 2 per cent of this figure.

This continuation of the digital divide by the back door is even more pernicious for broadband Internet. In the United States a monthly subscription costs 0.4 per cent of GNI per capita compared to over 5,000 per cent in Burkina Faso. The cost of accessing data via the Internet on mobile phones in developing countries is usually prohibitive.

Educators find themselves in a dilemma. On the one hand mobile phones are a highly valued personal technology. The authors report that one-third of UK owners would not give up their mobile for a million pounds; young adults see their mobiles as a 'critical social lifeline'; and most 16- to 24-year-olds would rather give up alcohol, chocolate, sex, tea or coffee than live without

their mobile for a month. It is clearly attractive for educational institutions to use such a valued personal device to communicate with students 24/7 and to embed learning in their lives.

Sadly, however, cost is not the only obstacle to such use in the developing world. Screen size is a problem for communication of text or images, and battery life can be short. These problems posed a dilemma for some of the projects described in this book. To explore the learning potential of mobiles they provided students with up-market devices, although this negated the aim of achieving sustainable learning processes using the devices that students actually own.

This brief book offers a useful first pass at a technology that will increase in importance. I find it particularly interesting that the authors reported so much writing on the theory of mobile learning. In earlier days of distance education, critics alleged that practice ran ahead of theory; this time it is the other way around. Definitions and taxonomies already abound, even though much of the theorising seems to be based on abstract reasoning rather than on observation of practice. The book does, however, make the important point that mLearning means the use of mobile devices in learning, not that the student is mobile while learning. An experiment showed that subjects who tried to learn from an iPod while walking a path that required them to pay attention to their footing did not recall the lesson as well as those who were stationary.

So far the surefire winners in mLearning are short message services (SMSs) for administrative purposes. Reminding students of deadlines, giving words of encouragement and providing bite-size learning snippets have a beneficial impact on motivation and make it more likely that students will complete and pass the course.

I congratulate the authors on their persistence and ingenuity in researching a fast-moving field that required them to delve into the fugitive literature as well as more orthodox scholarship. The synergy between the work of the African and European authors is impressive.

As the power and sophistication of mobile devices increases and the cost of using them goes down, mobiles will take their place as an important part of the toolkit of open schooling. Meanwhile, this publication is a useful primer to a technology that has engaged people as never before but is still in its infancy as a means of education.

Sir John Daniel
President, Commonwealth of Learning

ABBREVIATIONS

BBC: British Broadcasting Corporation

BETT: British Education and Training Technology

CD: Compact Disc

COL: Commonwealth of Learning

CSIR: Council of Scientific and Industrial Research

CTAD: Cambridge Training and Development

DEEP: Digital Education Enhancement Programme

EDEN: European Distance Education Network

ESOL: English for Speakers of Other Languages

GPS: Global Positioning System

GCSE: General Certificate of Secondary Education

GSM: Global System for Mobile (*Groupe Spécial Mobile*)

ICT(s): Information and Communication Technology (or Technologies)

IVR: Interactive Voice Response

JISC: Joint Information Systems Committee

M4G: Mobile for Girls

MELFA: Mobile E-Learning for Africa

moblog: Mobile Blog

MoLeNET: Mobile Learning Network

MRSI: Mobile Research Support Initiative

NVQs: National Vocational Qualifications

ODL: Open and Distance Learning

OU: Open University

PC: Personal Computer

PDA: Personal Digital Assistant

SMS: Short Message Service

VAT: Value Added Tax

BACKGROUND

"Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory."

— Article 26, para. 1, Universal Declaration of Human Rights, 1948

Education has been recognised as a human right, and it is an investment for national development. Therefore, various governments in both developed and developing countries are concerned about the poor state of education and literacy. In 1990, the first World Conference on Education for All (WCEFA) held in Jomtien, Thailand, set the target to eradicate illiteracy globally by 2000. The failure of Jomtien declaration led to shifting of the target to 2015 in the World Education Forum, Dakar, Senegal, in 2000 and in the Millennium Development Goals (MDGs) adopted by the 189 governments in the United Nations Millennium Summit in 2000. The UNESCO's Global Monitoring Report (GMR) on Education for All (EFA) 2009 reports the following depressing statistics (UNESCO, 2008):

- Projections for 134 countries accounting for some two-thirds of out-of-school children in 2006 suggest that some 29 million children will be out of school in 2015 in these countries alone.
- Children from poor households, rural areas, slums and other disadvantaged groups face major obstacles in access to a good quality education.
- In sub-Saharan Africa, 75 per cent of secondary school age children are not enrolled in secondary school.
- An estimated 776 million adults — or 16 per cent of the world's adult population — lack basic literacy skills. About two-thirds are women. Most countries have made little progress in recent years. If current trends continue, more than 700 million adults will lack literacy skills in 2015.

The UNDP's Millennium Project (2005) reported that putting every child in the world in quality primary school would require an investment of US$7 to US$17 billion every year, and governments may have to increase their education spending by 1.1 per cent every year up to 2015. As countries in different regions also differ in terms of their affordability to increase investments in primary education, external donor funding would be needed to meet demand.

Open and distance learning (ODL), including the use of information and communication technologies (ICTs), has been identified as one of the major strategies to increase access to education (Unterhalter et al., 2000) because of its cost-efficiency, quality, effectiveness and equity (Yates, 2000; Du Vivier, 2008) as it has the potential to reach remote and disadvantaged sections of the society. The approaches to improve access to basic education include the use of radio, television, interactive radio instructions, interactive television and open schools, which may use a variety of media and technology (Jenkins and Sadiman, 2000; Yates and Tilson, 2000).

OPEN SCHOOLS

"Open schools are institutions that provide education through open and distance learning methods" (Du Vivier, 2009) at the school level. They use a concept called "open schooling," which involves "the physical separation of the school-level learner from the teacher, and the use of unconventional teaching methodologies, and information and communications technologies (ICTs) to bridge the separation and provide the education and training" (COL, n.d.). Open schooling extends the opportunity of receiving formal education outside traditional school environment. "This may be achieved through special institutions — "open schools" — or through the use of the techniques of distance education to extend opportunity for schooling to those otherwise excluded" (Jenkins and Sadiman, 2000). Thus, open schooling covers:

- teaching children out of school;
- providing adults with school-level learning; and
- extending the range of learning for pupils in schools (Jenkins, 2003).

Normally, open schools are autonomous organisations that undertake the first two of the above. The first open school programme is believed to have begun in 1914 in Australia (Mukhopadhyay, 1994). However, Moore and Kearsley (1996) reported that by 1906 the first primary school was enrolling students through correspondence in the United States. Open schools were introduced in Canada in 1919 and in New Zealand in 1922. The first School of the Air started in the United States in 1924 (Bianchi, 2008). Today, open schools are found in all parts of the world, especially in the Asia and Africa, contributing towards access to school level basic education. Some of the institutions using the concept of open schooling around the world are:

- Bangladesh Open School (1997)
- Botswana College of Open and Distance Learning (1998)
- Malawi College of Distance Education (1988)

- Namibian College of Open Learning (1997)
- National Institute of Open Schooling, India (1989)
- New Zealand Correspondence School (1922)
- Open Junior Secondary School, Indonesia (1979)
- South Korean Air Correspondence High School (1992)

Open schools have the potential to transform national education systems by effecting change in the following areas (Du Vivier, 2009):

- *Access and reach* — Open schools can deliver secondary education to remote pupils and reach communities that have never had such opportunities.
- *Costs and efficiency* — If organised in the right way and with attention to cost reduction, open schools can reap the benefits of the economies of scale that distance education holds out as a possibility.
- *Equity* — Open schools can reach marginalised groups and provide affordable education to those with limited means. In this way, open schooling can address issues of equity either by rectifying past inequalities of access or by expanding provisions for addressing issues of massive shortage.
- *Quality and effectiveness* — With proper attention to quality assurance processes, open schools can function well and offer as good an education as, and sometimes a better education than, that available through the conventional system.

LEARNER SUPPORT

As in any distance education system, open schools use a variety of media and technologies in teaching and learning apart from the use of self-learning text, audio and video. Yet again, supporting learners in open schools are as important as in any other distance education system. Keegan (1996) identified two distinct sub-systems in any distance education system: (1) course development and (2) student support services. Student support is the "assistance and guidance that students are offered above and beyond the learning materials" (LaPadula, 2003). Experience shows that students need support if they are to succeed (Rumble, 2000). According to Sewart (1993) learner support is the means through which individuals are enabled to make use of the institutionalised provisions. He considered learner support activities as services that are produced and consumed at the same time. According to Tait (2000), learner support covers the "range of services both for individuals and for students in groups which complement the course

materials or learning resources that are uniform for all learners." He goes on to categorise learner support as cognitive (those mediating elements that are included in the learning materials to facilitate learning), affective (creation of an environment that gives self-esteem, commitment and belongingness) and systemic (that addresses administrative processes).

Basically there are two types of learner support (Thorpe, 2002): (1) institutional (for example, how to apply for a course, fees related information, last dates, and so on) and (2) course related (for example, solving difficulties, working on assignments, discussions, and so on). Simpson (2002) categorises learner support as academic and non-academic.

Academic support consists of:

- defining the course territory;
- explaining concepts;
- exploring the course;
- offering feedback through both informal and formal assessment;
- developing learning skills such as numeracy and literacy;
- chasing progress, following up student's progress through the course; and
- providing enrichment by extending the boundaries of the course and sharing the excitement of learning.

Non-academic support consists of:

- advising by providing information, analysing problems and suggesting actions or directions;
- assessing achievement by giving feedback to individuals on non-academic aptitudes and skills;
- providing study skills guidance and help;
- writing reference letters and making a case for funding support;
- undertaking learner's issues with the administration; and
- organising learner support events.

Tait (2000) listed the range of learner support activities as follows:

- enquiry, admission and pre-study advisory services;
- tutoring;
- guidance and counselling services;
- assessment of prior learning and credit transfer;
- study and examination centres;
- residential schools;
- library services;
- individualised correspondence teaching, including in some cases continuous assessment;
- record keeping, information management and other administrative systems;
- differentiated services for students with special needs of one sort or another (for example, disability, geographical remoteness, or prisoners); and
- materials which support the development of study skills, programme planning or career development.

The use of learner support is distinctive to distance education system, and it has been expected to be performed at a different time and often by a group of people different from those producing the course materials (Thorpe, 2002). The operational complexities of the distance education system also favour a multi-point support structure rather than a centralised single-point contact (Sinha, 1995). This has changed with the introduction of online and collaborative learning. With the use of computer-mediated communication (CMC), student support receives a new meaning, particularly in enhancing social dimension and reducing barriers of time and space (Tait, 2000). The use of electronic online communication to deliver information and advisory services can replace print and telephone over a period of time (Phillips et al., 1998). The use of new ICTs can be justified through improved service availability, speedier service delivery, cost savings through a reduction in administrative activity and an increased level of interaction with the learner (Phillips and Hawkins, 2003). A range of new technologies can be put to use in distance education, including e-mail, discussion boards, virtual help desks, online tutoring and mobile technology. These technologies can radically change the guidance and counselling practice both face-to-face and in distance education (Tait, 1999). According to Tait, the new technologies do the following:

- improve the volume and range of information available;
- provide access to more human sources of guidance and counselling;
- improve communication at both individual and group levels; and
- make it possible for learners to reach for support from anyplace and at anytime.

And, it is in this context that this publication reviews and analyses the emergence of mobile telephony as a medium to provide learning and support services to students in open schools.

ABOUT THE PUBLICATION

The main objectives of this publication are to:

- review the use of mobile technologies in teaching and learning, usually referred to as mobile learning or m-learning;
- present the use of mobile technologies in open schooling, as analysed through two desktop research projects in Africa and Europe; and
- list the lessons learned and propose guidelines on use of mobile technologies in open schools.

Mobile Technologies in Open Schools is intended as an introductory guide to orient functionaries of open schools to consider use mobile technologies for teaching and learning support. It highlights the possibilities and potentials of the mobile technologies for various functions in the open schools through the use of short message service (SMS), podcasting, video and mobile Web services. This publication is also intended as a reference point for decision-makers, planners, teachers and administrators of open schools to guide them to the world of mobile technologies. Keeping these intentions in view, the publication has been organised in six sections:

A **Background** section provides an overview of the situation prevailing on education in general and primary and secondary education, in particular in the context of the Education for All agenda and the Millennium Development Goals. This background section also discusses the role open schools can play in providing access to basic education, and it emphasises the role of student support as an important function in the open school. Further, the section covers both academic and non-academic activities surrounding learners' success.

Chapter 1 entitled A **Introduction and Literature Review** makes a case for use of mobile technologies in open schools, not only because of learners' increasing access to mobile technologies, but also because mobile technologies provide anytime, anywhere support to both academic as well as administrative requirements through the use of SMS and other technologies.

Chapter 2 presents an edited version of a report that looked at the use of mobile technologies in Africa for learner support through a desktop survey, visits and interview of the stakeholders. This report forms the basis of the guidelines in Chapter 4.

Chapter 3 presents an edited version of a report that looked at the use of mobile technologies in Europe for learner support through a desktop survey, visits and interview of the stakeholders. This report also forms the basis of the guidelines in Chapter 4.

Chapter 4 presents Lessons Learned and Guidelines to use mobile technologies in open schools.

A **Glossary** of terms used in mobile technology helps users of this publication to understand some of the technical jargon used in the discourse of mobile learning.

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CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

"Mobile learning is a harbinger of the future of learning." (Keegan, 2002)

MOBILE TECHNOLOGY: TOWARDS UBIQUITY

Consider the following statistics, current to January 2009:

- total circulation of all daily newspapers worldwide = about 480 million
- total number of cars on the road = about 800 million
- total cable and satellite television subscriptions = 850 million

Numbers increase for newer technologies:

- desktops, laptops and netbooks currently in use = 1 billion
- fixed land line telephone connections = about 1.2 billion
- e-mail users = about 1.3 billion
- Internet users = about 1.4 billion
- credit card users = about 1.7 billion

Now consider this statistic: 4 billion people subscribed to mobile phone subscriptions in the same time period (Ahonen, 2009).

Certainly the world has gone mobile! The mobile penetration is about 61 per cent of the total population of the world. "In the developing world, mobile phones have revolutionized telecommunication and have reached an estimated average 49.5 per cent penetration rate at the end of 2008 — from close to zero only ten years ago" (ITU, 2009). In Africa mobile penetration has risen from just one in 50 people at the beginning of this century to more than one-quarter of the continent's population today. Africa's mobile penetration of 28 per cent compares to 38 per cent in Asia, 72 per cent in the Americas, 79 per cent in Oceania and 111 per cent in Europe (ITU,

2009). Mobile penetration in selected Commonwealth countries is given in Table 1. The Cumulative Annual Growth Rate (CAGR) for the selected countries is more than 55 per cent. This indicates the potential of the mobile technology to provide greater access to people in remote and geographically disadvantaged locations. “In regions with difficult geography or poor economic conditions, mobile networks can be designed and implemented in far quicker and cost-efficient ways than fixed networks” (Dholakia and Dholakia, 2004).

Motlik (2008) in an evaluative report on the relevance of mobile learning to developing nations states that e-learning or Web-based learning is a misfit for the Asian region and developing countries. Instead, as the mobile phone technology is widespread, easy-to-use and familiar to both learners and instructors, the Asian distance education community has the opportunity lead development of the mobile phone's educational uses worldwide. “Mobile phone use in DE will not only benefit learners in Asia, but can be exported to other developing and developed areas around the globe. Mobile phone diffusion in Asia particularly is spreading at a dramatic rate with the advent of cheaper handsets and better services” (Motlik, 2008), and, therefore, mobile technologies should be the preferred mode of teaching and learning support. Keegan (2002, 2005) declared that the future of distance education is wireless as there had never been a technology that has penetrated the world with the depth and rapidity of mobile telephony. He claims that the challenge for distance educators is to accept this fact and to now develop pedagogical environments for mobile devices.

TABLE 1. **MOBILE PENETRATION IN SELECT COMMONWEALTH COUNTRIES (SOURCE: ITU, 2009)**

Mobile cellular subscribers				
	(000s)		CAGR (percentage)	per 100 inhabitants
	2002	2007	2002–2007	2007
Australia	12'670.0	21'260.0	10.9	102.49
Bangladesh	1'075.0	34'370.0	100.0	21.66
Botswana	332.3	1'151.8	28.2	61.21
Brunei Darussalam	153.6	348.9	17.8	89.45
Canada	11'872.0	20'277.4	11.3	61.68
Fiji	89.9	530.0	42.6	63.20
Gambia	100.0	800.4	51.6	46.84
Ghana	386.8	7'604. 1	81.4	32.39
India	13'000.0	233'620.0	78.2	19.98
Jamaica	1'245.0	2'684.3	16.6	98.91
Kenya	1'187.1	11'349.4	57.1	30.23
Liberia	2.0	563.0	209.0	15.01
Malawi	86.0	1'050.9	65.0	7.55
Malaysia	9'053.0	23'347.0	20.9	87.86
Maldives	41.9	313.5	49.6	102.61
Mauritius	348.1	928.6	21.7	73.60

Mobile cellular subscribers				
	(000s)		CAGR (percentage)	per 100 inhabitants
	2002	2007	2002–2007	2007
Mozambique	254.8	3'300.0	66.9	15.42
Namibia	150.0	800.3	39.8	38.58
New Zealand	2'449.0	4'251.2	11.7	101.74
Nigeria	1'569.0	40'395.6	91.5	27.28
Pakistan	1'698.5	62'960.8	106.0	38.41
Singapore	3'313.0	5'924.1	12.3	133.54
South Africa	13'702.0	42'300.0	25.3	87.08
Sri Lanka	931.4	7'983.5	53.7	41.37
Tanzania	606.9	8'322.9	68.8	20.57
Trinidad & Tobago	262.8	1'509.8	41.9	113.24
Uganda	393.3	4'195.3	60.5	13.58
United Kingdom	49'228.0	73'224.2	8.3	120.50
Zambia	139.1	2'639.0	80.1	22.14
Zimbabwe	338.8	1'225.7	29.3	9.18

MOBILE LEARNING

Educators' tryst with technology has a long history. Thus, the field of education has seen many innovations and innovative use of common technologies for teaching and learning, including the use of television, radio, computer and the Internet. Despite Thomas A. Edison's 1922 prediction "that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks", despite the volume of research documenting "no significant difference" in student outcomes between alternate modes of education delivery (see www.nosignificantdifference.org) and despite the debate over the question "Do media influence learning?" (Clark, 1994; Kozma, 1994), technology use has dominated educational discourse in the 20th century. In the beginning of the 21st century, the use of mobile telephony in education gave birth to a new wave called "mobile learning" ("m-learning"). The popularity of mobile learning can be appreciated from the large number of publications and conferences on the subject since 2001. Keegan et al. (2008), after a survey of mobile learning provisions in 28 European countries, reported that the most striking example of the vibrancy and importance of mobile learning today is the attendance at the 2007 annual Hand-held Learning conference convened at Westminster Hall, London, United Kingdom, which registered more than 800 delegates. According to Kim et al. (2004), "Mobile wireless technology provides efficient and effective communication and network connectivity for teachers and students in K–12 education because it does not require any wires." As mobile technology is pervasive, users no longer need to worry about access to the computer lab for technology activities, software assignments or Internet access, and its operational simplicity makes it the next killer application.

Developments in the field of mobile technology are so fast that a comprehensive review of literature would be highly difficult and time consuming. Moreover, as in any developing field, a certain amount of repetition appears in the literature, along with a tendency to explain the basics of the technology. At the same time, the research literature is also strong, and Bischoff (2009) reported the use of mobile phone to access remote laboratory equipment such as a robot. The present literature review is selective as well as purposive to provide an introduction to mobile technology and its application in school settings. In order to undertake this survey a large number of databases such as the ProQuest, EBSCO, IEL, InformaWorld, Elsevier, and so on, were searched in addition to the usual Google search. Based on these results, this literature review has been organised to discuss definitions, advantages and uses, design and developments, costs, impacts, theoretical implications and limitations. Guidelines and lessons learned are discussed separately in Chapter 4 and therefore have not been included in this introduction and review.

DEFINITIONS

> "The term 'mLearning' has lately emerged to be associated with the use of mobile technology in education. It seems, however, that it is used in commercial purposes rather than as an educational concept. We wonder if the term is a commercial trick to market technology and educational services or if it an emerging concept that educationalists take seriously" (Sariola et al., 2001).

Interestingly learning cannot be mobile, but learners are mobile and they use mobile technologies (Keegan, 2002). If serving the mobile learners is the focus of m-learning, then distance education institutions have always been doing this — serving learners anytime, anywhere. For some, m-learning is e-learning delivered through mobile devices, and Keegan (2002) takes this point when he represented m-learning through a diagram showing links to other materials, the World Wide Web, interactions among students, interactions between the student and the teacher, provision of learning materials and student support services. Thus, for Keegan, mobile learning is provision of teaching and learning on a mobile device. "Mobile learning (m-learning) is defined as the provision of education and training on mobile devices: Personal Digital Assistants (PDAs), smartphones and mobile phones" (Keegan, 2006). Ally (2004) defined m-learning as the delivery of electronic learning materials on mobile computing devices to allow access from anywhere and at anytime. According to Quinn (2000) m-learning can be defined as learning that takes place with the help of portable electronic tools. Stone (2004) defines m-learning as a special type of e-learning, bound by a number of special properties and the capability of devices, bandwidth and other characteristics of the network technologies being used. Geddes (2004) defines it as the acquisition of any knowledge and skill through the use of mobile technology, anywhere, anytime, which results in an alteration in behaviour. However, Laouris and Eteokleous (2005) claim that a precise educational definition of m-learning is yet to be achieved.

A portable device that supports learning may be freely moved, but learner is mostly stationary, even though they are using a mobile device. Although the device is mobile and portable, the learning as an event cannot be described as mobile (Ahonen et al., 2004). According to Laouris and Eteokleous (2005) the definition of m-learning must view the learner as the one being mobile and not his or her devices. O'Malley et al. (2005) define mobile learning more broadly as "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies." Mobile wireless technology involves two areas — mobility and computing. "Mobility" in this context is defined as continuous accessibility to users, and "wireless" means communication using radio waves, infrared waves and microwaves instead of cables or wires in order to transport a signal to connect communication devices (Malladi and Agrawal, 2002). Kim

et al. (2004) define “mobile wireless technology” as technology that provides continuous accessibility to users anytime, anywhere without using wire or cable to connect to networks (like the Internet), to transmit data or to communicate with others. Colazzo et al. (2003) state that mobile learning can be considered as any learning and teaching activity that is possible through mobile tools or in settings where mobile equipment is available. Traxler and Kukulska-Hulme (2005) define m-learning as a personal, unobtrusive, spontaneous, “anytime, anywhere” way to learn and to access educational tools and material that enlarges access to education for all.

Thus, mobile learning includes access to electronic materials and resources mediated by mobile devices for the exclusive purpose of teaching and learning support. Taken this view, m-learning is a sub-set of e-learning available through mobile technology to facilitate learning on the go. Koole (2009) has proposed a framework for understanding mobile learning. According to this framework, mobile learning falls within the intersection of learner, device and social aspects as represented in Figure 1. The labels in the illustration can be explained as follows:

- *Device Aspect* — refers to size, weight, input or output capabilities, file storage and retrieval, processor speed of the equipment.
- *Learner Aspect* — refers to their prior knowledge, memory, context and transfer, discovery learning, emotions and motivations.
- *Social Aspect* — refers to conversations, co-operation and social interactions among users.
- *Social Technology (DS) intersection* — refers to device networking, system connectivity and collaboration tools.
- *Interaction Learning (LS) intersection* — refers to interaction, situated cognition and learning communities.
- *Device Usability (DL) intersection* — refers to portability, information availability, psychological comfort and satisfaction.
- *Mobile Learning (DLS)* — refers to information access and selection, mediation and knowledge navigation in mobile learning.

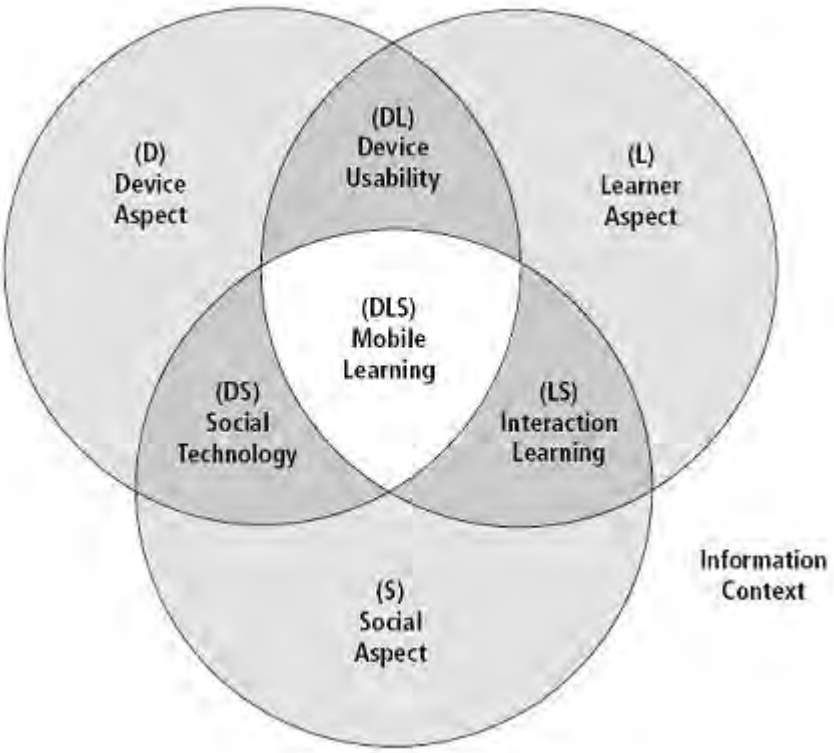

Figure 1. Mobile Learning: A Framework (*Source*: Koole, 2009)

ADVANTAGES AND USES

Some key advantages of mobile learning include the following (Attewell, 2005):

- allows truly anywhere, anytime, personalised learning;
- can be used to enliven, or add variety to, conventional lessons or courses;
- can be used to remove some of the formality which non-traditional learners may find unattractive or frightening and can make learning fun;
- can help deliver and support literacy, numeracy and language learning;
- can help learners and teachers to recognise and build on existing basic literacy skills which allow young people to communicate in notational form via text messages;
- facilitates both individual and collaborative learning experiences;

- enables discrete learning in the sensitive area of literacy;
- can help to combat resistance to the use of ICT by providing a bridge between mobile phone literacy and PC literacy;
- has been observed to help young disconnected learners to remain more focused for longer periods; and
- can help to raise self-confidence and self-esteem by recognising uncelebrated skills, enabling non-threatening, personalised learning experiences and enabling peer-to-peer learning and support.

Analyses of 12 international case studies by Kukulska-Hulme and Traxler (2005) reveal the reasons of m-learning use in several different contexts.

ACCESS

- improving access to assessment, learning materials and learning resources;
- increasing flexibility of learning for students; and
- compliance with special educational needs and disability legislation.

CHANGES IN TEACHING AND LEARNING

- exploring the potential for collaborative learning, for increasing students' appreciation of their own learning process and for consolidation of learning;
- guiding students to see a subject differently than they would have done without the use of mobile devices;
- identifying learners' needs for just-in-time knowledge;
- exploring whether the time and task management facilities of mobile devices can help students to manage their studies;
- reducing cultural and communication barriers between staff and students by using channels that students like; and
- wanting to know how wireless or mobile technology alters attitudes, patterns of study and communication activity among students.

ALIGNMENT WITH INSTITUTIONAL OR BUSINESS AIMS

- making wireless, mobile, interactive learning available to all students without incurring the expense of costly hardware;
- delivering communications, information and training to large numbers of people regardless of their location;
- blending mobile technologies into e-learning infrastructures to improve interactivity and connectivity for the learner; and
- harnessing the existing proliferation of mobile phone services and their many users.

According to Naismith et al. (2004) use of mobile technology in education can be categorised into six main themes:

(1) *Behaviourist* — activities that promote learning as a change in observable actions (drill and feedback model).

(2) *Constructivist* — activities in which learners actively construct new ideas or concepts based on both their previous and current knowledge (participatory and interactive model).

(3) *Situated* — activities that promote learning within an authentic context and culture (authentic and contextual model).

(4) *Collaborative* — activities that promote learning through social interaction (conversational and shared model).

(5) *Informal and lifelong* — activities that support learning outside a dedicated learning environment and formal curriculum (personalised, outside formal application model).

(6) *Learning and teaching support* — activities that assist in the co-ordination of learners and resources for learning activities (learning support model for academic, administrative and technical purposes).

From a developing country perspective, features such as limited or no dependence on permanent electricity supply, easy maintenance, easy-to-use audio and text interfaces, affordability and accessibility are the most important considerations for using mobile phones as potential learning tools (Masters, 2005; Mutula, 2002; Stone et al., 2003).

Based on the use pattern, Traxler (2007) has categorised mobile learning as:

- *Technology-driven mobile learning* — Some specific technological innovation is deployed in an academic setting to demonstrate technical feasibility and pedagogic possibility.
- *Miniature but portable e-learning* — Mobile, wireless and hand-held technologies are used to re-enact approaches and solutions already used in "conventional" e-learning, to provide access to some virtual learning environment (VLE) using mobile technologies as flexible replacements for desktop technologies.
- *Connected classroom learning* — The same technologies are used in classroom settings to support collaborative learning, perhaps connected to other classroom technologies such as interactive whiteboards.
- *Informal, personalised, situated mobile learning* — The same technologies are enhanced with additional functionality (for example, location-awareness or video-capture) and deployed to deliver educational experiences that would otherwise be difficult or impossible.
- *Mobile training or performance support* — The technologies are used to improve the productivity and efficiency of mobile workers by delivering information and support just-in-time and in context for their immediate priorities.
- *Remote, rural or development mobile learning* — The technologies are used to address environmental and infrastructural challenges to deliver and support education where "conventional" e-learning technologies would fail, often troubling accepted developmental or evolutionary paradigms.

TECHNOLOGIES IN M-LEARNING

It is generally accepted that devices such as mobile phones, PDAs and MP3 players fit into the category of mobile devices (Mellow, 2005; Andronico et al., 2003). However, laptop and notebook computers are sometimes not considered as mobile devices. "While they are capable of working without plugging into a power source and can utilize wireless networks, they are not devices that people can carry everywhere and quickly access at any time due to their size, configuration, and the time required to boot up and shut down" (Caudill, 2007).

Attewell (2005) categorises technologies used in m-learning into five categories:

- delivery options;
- platform options;
- media options;

- development languages; and
- transport options.

To this list we may add another category — device options. A clarifying concept map of technologies used in m-learning is given in Figure 2.

Klopfer et al. (2002) identified five properties of mobile devices that produce unique educational affordances:

- Portability — The small size and weight of mobile devices means they can be taken to different sites or moved around within a site.
- Social interactivity — Data exchange and collaboration with other learners can happen in both synchronous and asynchronous mode.
- Context sensitivity — Mobile devices can both gather and respond to real or simulated data unique to the current location, environment and time.
- Connectivity — A shared network can be created by connecting mobile devices to data collection devices, other devices or to a common network.
- Individuality — Scaffolding for difficult activities can be customised for individual learners.

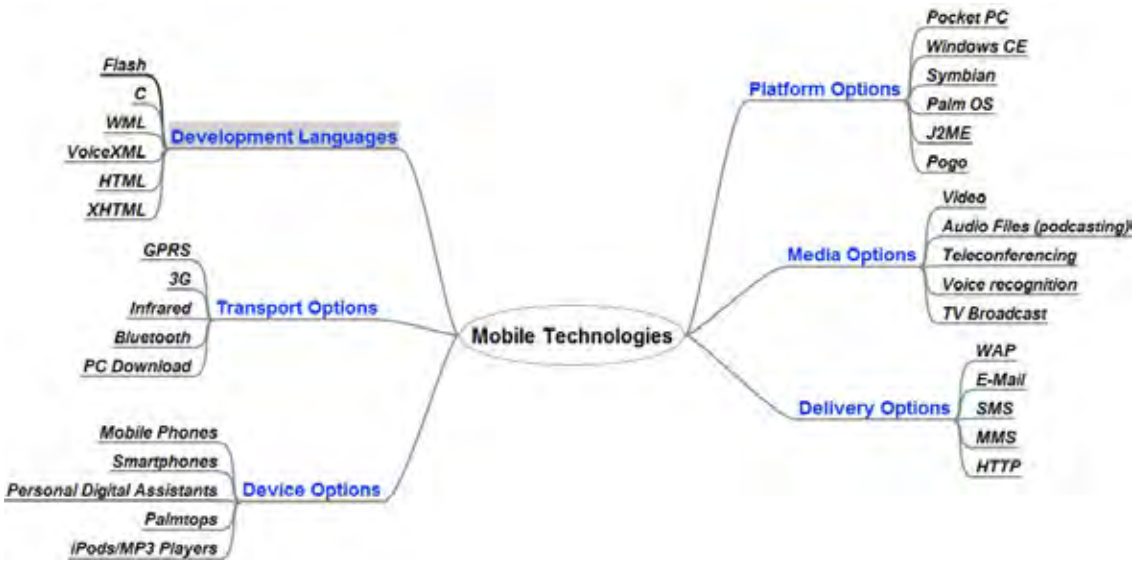

Figure 2. Mobile Learning Technologies (Adapted from Attewell, 2005)

Keegan (2006) describes a range of mobile technologies used for administrative support as well as for teaching and learning through the use of SMS (for support, for quizzes and for assignment advice); personal or peer tutoring through mobile devices; instructional delivery through podcasting over mobile devices; and content delivery through appropriate design of the learning materials to suit different mobile devices.

A large number of experimental studies are reported in literature covering the use of mobile technologies such as mobile phones (for example, Motiwalla, 2007; Thornton and Houser, 2001, 2002, 2005; Stockwell, 2007; Tan and Liu, 2004; Mellow, 2005); MP3 players (for example, McCarty, 2005); and PDAs (for example, Patten et al., 2006). Studies and projects cover the use of mobile technologies in both formal and informal literacy development (Cabrere, 2002; Chinnery, 2006; Joseph et al., 2005; Kadyte, 2003; Kiernan and Aizawa, 2004; Levy and Kennedy, 2005; Norbrook and Scott, 2003; Paredes et al., 2005; Thornton and Houser, 2005; Ogata and Yano, 2004). The most used technologies are SMS (Mellow, 2005), hand-held computers such as Palm (Mifsud, 2003), PDAs (Rekkedal and Dye, 2007) and podcasting (Nataatmadja and Dyson, 2008). It may be noted here that SMS and podcasting are services within hardware technologies such as the smartphone, and PDA though SMS is available in almost all basic mobile phones.

HAND-HELD COMPUTERS

Hand-held is a generic term used for PDAs, palmtops and laptop computers. The Palm Education Pioneer (PEP) programme was one of the earliest comprehensive mobile learning initiative covering 102 classroom teachers in K–12 schools in the United States. The final evaluation of the programme revealed an overwhelmingly positive response about the use of hand-held computers in classrooms. Approximately 90 per cent of PEP teachers stated that hand-helds are an effective instructional tool and hand-helds have the potential to have a positive impact on students' learning. Teachers found that use of hand-held computers in the classroom increased student motivation and improved collaboration and communication. However, key drawbacks included inappropriate use of technology, management issues related to synchronisation and equipment damage. A personal use strategy rather than shared strategy was more likely to increase students' time spent on schoolwork outside of school time (Vahey and Crawford, 2002).

Vogel et al. (2007) reported that students who already engaged in use of mobile devices found that use of a PDA enhanced their learning experiences. Moreover, those students who received support through mobile devices also reported increased performance enhancement. It has also been reported that PDAs are effective in improving knowledge creation during experiential learning (Lai et al., 2007) among fifth-grade students.

Mahamad et al. (2008) present a case of implementation of m-learning for primary schools in Malaysia by using open source technology. The case study focused on learning mathematics using hand-held devices among primary school students aged 11 and 12 years. Main users for this system included students, teachers and the administrator. This application suggests a new mobile learning environment with a mobile graph for tracking the students' progress and performance.

SHORT MESSAGE SERVICE

Short message service has the widest application in teaching and learning, as it is available in most basic mobile devices available in the market, and it can be used for both teaching and learning support. Viljoen et al. (2005) from the University of Pretoria experimented with the use of different types of SMSs to support learners and found that learners liked the academic instructions most, followed by mini lectures, interactive quiz, interactive student questions and instructional lecturer response, indicating learners wanted direct and short help messages. Cavus and Ibrahim (2009) reported an increase of more than 65 per cent in post-test score of learning new English words through SMS teaching. Jones and Edwards (2009) used text SMS to support student learning, and their study revealed many students perceived the SMS communication to have had a positive impact on their management of study time. Jones and Edwards argued that mobile text-based communication has the potential to support the development of time management skills, an important component of self-regulatory learning.

Traxler and Dearden (2005) in the context of sub-Saharan Africa presented a detailed report on potential applications of SMS in school empowerment, as the capital cost is negligible and the sunning cost is nominal. They emphasised SMS can be used for delivering distance learning programmes as follows:

- to provide study material, giving week-by-week support, maintaining momentum, contact, morale and continuity;
- to provide content support such as hints, tips, outlines, lists, summaries and revision;
- to provide reminders for assessment, contact, broadcast, discussion, video and meetings;
- to discuss in the form of feedback, seminars and queries;
- to provide encouragement and motivation; and
- to provide urgent alert messages about errata, cancellations and changes.

PODCASTING

Lee and Chan (2007) argue that podcasting can be used to deliver a form of m-learning that offers a higher degree of lifestyle integration than many current "state of the art" m-learning applications. Haaparanta et al. (2007) present the use of podcasting by teachers in schools using mobile phones.

VIDEO USE

Uses of video in m-learning have also been demonstrated by Doolittle and Mariano (2008) and Maniar et al. (2008). The use of mobile technology as a gaming device (for recreation and entertainment) makes it highly potential tool for educational usage despite the fact that these devices have very small screen size and therefore may require special developmental efforts. Small nuggets of video and animation can be used for teaching specific skills just in time.

DESIGN AND DEVELOPMENT

Although Grasso and Roselli (2005) recommended a set of guidelines for development of content for mobile learning, they also suggested rationalising because mobile devices have limited capacity and there is a risk of overloading the content giving rise to loading and storing problems. Park (2005) presented an adaptive approach to mobile learning management system that provides content adaptive to a learner's learning style. Accordingly, a learner is provided with the type of learning content adaptive to his or her learning style on the process of the individual learning. Bae et al. (2005) demonstrated that the use of an Attention-Relevance-Confidence-Satisfaction (ARCS) model in designing content is useful to learners at the school level. Tsai et al. (2005) presented a six-stage model for design and development of mobile learning, as follows:

- *Stage 1* — analysis of the learners' needs and mobile situation;
- *Stage 2* — integration of mobile technology–based instruction with a learning environment that uses digitised information;
- *Stage 3* — design of mobile instructional strategies;
- *Stage 4* — design and development of mobile learning content;

- *Stage 5* — implementation of instructional activities; and
- *Stage 6* — evaluation of mobile learning effect.

Ismail and Idrus (2009) reported the use of a SMS physics lesson at the Universiti Sains Malaysia. They suggested the following educational design considerations in the use of mobile phones:

- present course materials in a systematic and chronological way;
- present a "daily" chunk of information, including learning tips, laws, rules, simple formula, definitions, rhetoric, quiz, points to ponder, glossary, everyday examples, and so on;
- make materials available in diverse formats either to use text, image, audio or video according to the systems they are using, whether GPRS or 3G;
- ensure content is experientially real to students in the sense that they can engage in personally meaningful activity and learning;
- ensure students have capability to return the message for further action;
- incorporate SMS with electronic portal for archival purposes;
- incorporate interaction (via forum) in the electronic portal;
- create student groups via the hand phone;
- develop an easy interface; and
- utilise capabilities of hand phone such as saved messages, and so on.

Design and development of m-learning applications are important, and in this context the research and development in this area is not comparable to the developments in the field of e-learning. Today, many open source learning management systems such as Moodle, ATutor, and so on, among others deliver online learning. The same is not true for m-learning. Thus, most projects and institutions start from the basics and develop their own systems. Rather than focusing on the teaching and learning, the projects focus on technology developments. However, it is possible to deliver Moodle courses on mobile through the use of Mobile Moodle (MOMO), a JAVA-based application that allows Moodle clients to access a MOMO add-on to the Moodle learning management system (see www.mobilemoodle.org). Android (see www.android.com) is a free, open source mobile platform that includes an operating system and other software for development of Internet-like applications on mobile phones. The Tribal Group (see www.m-learning.org) in the UK has developed a set of software tools for development of lessons for

mobile, SMS quizzes, a discussion board and a student tracking system (see Appendix 4, CDEC, 2009). The design and development of mobile learning applications require a systematic approach and should be considered from a theoretical perspective as well a technological one.

COST

Cost is probably the most difficult aspect of mobile learning, for post-secondary institutions and particularly at the school level in the developing countries. Traxler (2003) identified elements of a theoretical basis for estimating and predicting the effectiveness, efficiency and economics of mobile learning as:

- content development costs;
- teaching costs;
- software development costs;
- hardware costs; and
- usage costs (for example, phone charges).

However, no in-depth analysis of these costs has yet been done. Experiences in the field of e-learning and distance learning show that the cost of m-learning is high at the present because of technological development, though m-learning has the potential to be much less costly due to economies of scale. Rekkedal and Dye (2009) accepted that cost-efficiency considerations prohibited them to develop parallel versions of courses for mobile learning. They recommend that "courses must be developed, presented, and distributed in a manner that allows both mobile and non-mobile distance learners to participate in the same course, using the same course materials that can be accessed from standard and mobile technologies."

IMPACTS

Many benefits accrue when hand-held computers are used (Juniu, 2003). The most important benefit to the learners and teachers is the opportunity to take the learning experience outside of the confines of the classroom. Perry (2003) states that wireless technologies, notably PDAs, are proving to benefit "family learning" as learners are able to use them for various literacy tasks, including note-taking and reading e-books, and then take the PDAs home to continue working on them with their parents. Barker et al. (2005) described three significant impacts of mobile technologies as "portability," "collaboration" and increased "motivation" of the learners. So, m-learning has the potential to change teaching and learning practices. Use of mobile devices in

education and training would increase communication and collaboration and provide authentic learning experiences to the students through field trips and group work. However, real impact of m-learning has not yet been seen as most applications are in project stage and are yet to be integrated into the mainstream of educational institutions. Learners are the biggest stakeholders in m-learning projects, and it should be a top priority to ascertain their needs to have positive impact later. Kim and Ong (2005) identified six factors affecting user satisfaction in m-learning, as follows:

- relevant content;
- service commitment of the m-learning provider;
- usability of the system;
- content accuracy and assurance;
- system assurance and performance; and
- community membership.

Thus, any m-learning provider should have a service policy and commitment, provide access to relevant learning materials developed on the basis of needs analysis and encourage the development of a community of learners.

THEORETICAL IMPLICATIONS

Without theoretical underpinnings, technological innovation would not be sustainable. So, this literature review has tried to look into the theoretical implications of m-learning, and the theoretical models that are used in the design, development and delivery of m-learning. Three standard schools of thought — behaviourism, cognitivism and constructivism — play significant roles in the use of mobile technology for teaching and learning. Collaborative learning, situated learning and social constructions of learning are dominant approaches apart from the behaviouristic approach of using quiz and provision for immediate feedback. Arrigo et al. (2004) presented an innovative mobile platform for computer-supported collaborative learning based on third-generation mobile telephones. Students in the system can collect and share live data immediately, anywhere and at any time, enabling them to play an active role in the knowledge-building process. Nyiri (2002) notes that knowledge is information in context, and since mobile devices enable the delivery of context-specific information, they are well placed to enable learning and the construction of knowledge.

Sharples et al. (2005) present a framework for theorising about mobile learning to inform the design of new environments and technologies to support mobile learning. Using the activity theory approach, they analyse learning as a cultural-historical activity system, mediated by tools that both constrain and support the learners in their goals of transforming their knowledge and skills. They identify two separate perspectives as layers: (1) semiotics and (2) technology. The semiotic layer describes learning as a semiotic system in which the learner's object-oriented actions are mediated by cultural tools and signs. The technological layer represents learning as an engagement with technology, in which tools such as computers and mobile phones function as interactive agents in the process of coming to know in a networked and connected world. Shih (2005) presents a modified ARCS model for designing m-learning that can be considered an instructional design approach. The learning cycle in the Shih's model as shown in Figure 3 includes:

- sending a multimedia message to mobile phones to trigger and motivate learners;
- searching the Web for related information by using hyperlinks (URLs) embedded in the message received;
- discussing with learning peers by text, voice, picture or video messaging;
- producing a digital story that tells what they learn through an audio or video diary (a moblogging journal); and
- applying what they learn in a simulated environment such as online educational gaming.

One of the major reasons m-learning does not work at the present level of development is a lack of teaching and learning models using mobile devices. Not enough has been done to experiment with m-learning using the various learning theories and instructional design models available. Keough (2005) presents "mobigogy" as distinct from "pedagogy" and "andragogy" for application in mobile technologies. Accordingly, mobigogy is a teaching and learning paradigm for the mobile technologies that is continuous, learner directed and believes in education as democracy. Mobigogy enables network thinking, dynamic learning in supported communities, sharing experiences and learning from others in an object-oriented, just-in-time knowledge model.

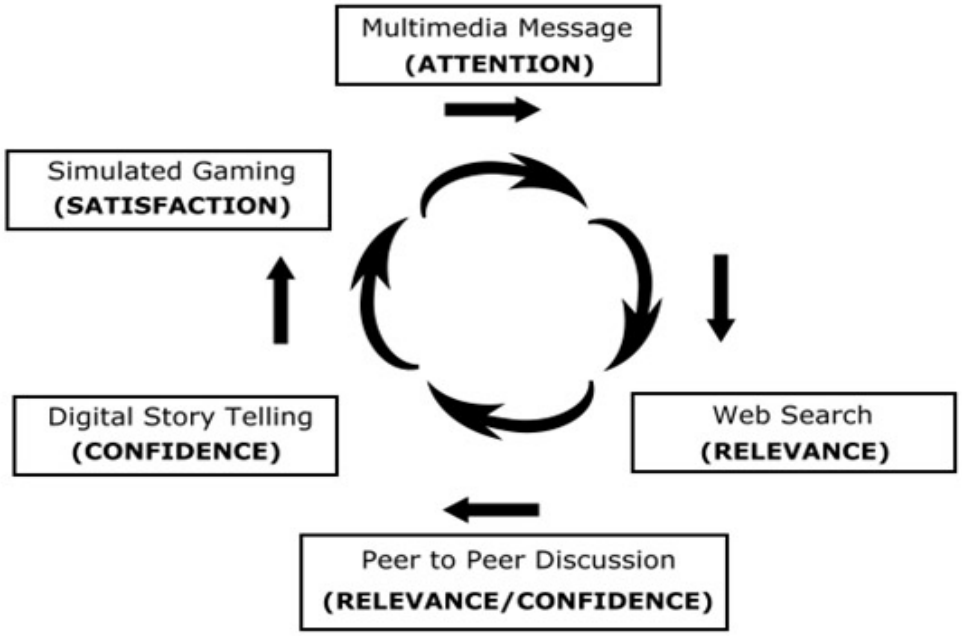

Figure 3. Learning Cycle in m-learning

LIMITATIONS

Most of the limitations of mobile learning are due to the small screen size of the mobile devices and their limited battery life. A study by Doolittle and Mariano (2008) found that learning while mobile was negatively affected in comparison to learning while stationary. They "found that students who learned about historical inquiry using a portable digital media player (for example, iPod), while navigating a walking course that required attention to the path taken, performed significantly more poorly on measures of recall and transfer than students who learned while simply sitting at a desk" (p. 524). This is a serious drawback, and exclusive use of mobile device for any teaching and learning is therefore not recommended.

Maniar et al. (2008) reported that regardless of the screen size of a mobile device, students tended to have a positive overall opinion of m-learning, and watching a video significantly increased their knowledge of the subject area. However, compared to students who used devices with 2.28-inch to 3.78-inch screens, students who used a device with a 1.65-inch screen had a significantly lower subjective opinion of the screen quality and learned a significantly lower amount. This finding indicates that if an m-learning environment that relies heavily on video-based material is displayed on a device with a 1.65-inch screen, such as an average mobile telephone, then the effectiveness of the learning experience may be inhibited. Zawacki-Richter et al. (2007) reported

that 62 per cent of respondents agreed that screens are currently too small to present complex learning material, and limited battery life of mobile devices was regarded as a problem for extensive use by 59 per cent of respondents. Despite these limitations, 50 per cent of the respondents believed that screen size is not as important as mobile devices should rather be used for communication and interaction purposes rather than for content distribution. Because of the small screen size in mobile devices, the interface should be built in such a way to convey the message using the smallest amount of text, and proper navigation must be built into the system to allow learners to move between screens and sections of the lesson (Ally, 2004).

Despite these small limitations, mobile devices should be seen as an opportunity to deliver just-in-time learning and support to learners in remote areas. As Sharples (2003) suggests, rather than seeing mobiles as disruptive devices, educators should seek to exploit the potential of the technologies children bring with them and find ways to put them into good use for the benefit of learning practice.

CONCLUDING REMARKS

This review points us not only to a significant amount of literature available on m-learning but also to various experiments and projects initiated in different parts of the world. While mobile devices are becoming ubiquitous, innovative uses of the technology have to be developed considering the special attributes of specific mobile devices. Generally, mobile devices can support small bite-sized content delivery, and therefore, its usage has to be for providing content is small nuggets, and in consideration of the storing and playing capabilities of the device in possession of the target group. The use of text, audio, video and animation or games are supported by different mobile devices, but the development of content appropriate to different types of tools is a costly proposition, and therefore, an adaptive and intelligent approach may be considered. Moreover, it is also useful to consider re-purposing the existing e-learning materials for m-learning delivery. As the content development tools for the mobile devices emerges, the use of mobile devices seems to be more appropriate for providing support to the learners through SMS, which is available in almost all mobile devices. The use of mobile for teaching and learning also has to go a long way in developing more robust pedagogical strategies suitable for the technology and its media capabilities. While mobile technology can facilitate the development of a constructivist learner, it also can promote mastery learning through drill and practice. The anytime, anywhere connectivity also makes it possible to access information in both tacit and explicit forms from the Web and through experts and peers. Future applications of mobile technology in schools should include an evaluation framework to measure it impact and develop theoretical understanding of the actual learning process while being mobile.

I would like to end this review by highlighting some of the findings of a Delphi study by Kurubacak (2007) on use of mobile learning technologies, its challenges, priority research areas and research needs, as follows:

MAJOR RESEARCH ISSUES AND CHALLENGES

- realise the dialectic relationship between personal technology and everyday learning;
- develop the multicultural standards of accreditation for mobile learning; technologies;
- provide learners with novel opportunities for synchronous online communications; and
- evaluate the usability of mobile applications.

MAJOR RESEARCH PRIORITIES

- address specific curriculum areas;
- diagnose communication problems that learners have with mobile learning technologies;
- ensure privacy for the distance learners;
- enhance different capabilities for rich social interactions; and
- explore emerging practices relating to the use of mobile learning technologies.

MAJOR RESEARCH NEEDS

- consider the use of mobile learning technologies to support collaborative learning;
- transform learning into a part of real life;
- support digital interactions dedicated learning milieus;
- engage in activities that do not correspond with the curriculum; and
- link to multicultural activities in the outside world.

In this review, we presented a generic overview of mobile learning technologies in education and training through a literature review. In the next two chapters, we present two different perspectives (from Africa and from Europe) of using mobile technology for learner support in open schooling. These two chapters are edited for presentation in this volume from two separate consultancy reports commissioned by the Commonwealth of Learning. In the last chapter, the

editor presents a set of guidelines and lessons learned for using mobile technology in open schools.

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CHAPTER 2: USING MOBILE TECHNOLOGY FOR LEARNER SUPPORT IN OPEN SCHOOLING: AN AFRICAN PERSPECTIVE

INTRODUCTION

Education is seen as an important contributor to the alleviation of world poverty and, in response, members of the United Nations set a goal to achieve Universal Primary Education. It was hoped that by implementing such an initiative all children world-wide would be able to successfully complete primary school by 2015. This commitment to primary education has resulted in a situation where increased levels of children have completed their primary education but access to secondary school is in many instances still an option available only to a select few. Open schooling at the secondary school level is an option that is being considered by developing countries as a solution to the bottleneck that limits learner access to secondary school education. The flexibility of open schooling makes it suitable for learners who cannot or will not attend a conventional classroom.

An initial background study commissioned by the Commonwealth of Learning (COL) to explore the potential of open schooling involved collaborators from several developing countries, including 11 African nations. The data collected during the study provided an overview of the general issues affecting access to secondary education for youth and adults in sub-Saharan Africa. Some of the main findings were that learners drop out of school for a variety of reasons, including shortage of spaces in school, cultural practices and the long distances to schools. It was agreed that open schooling was a potential solution to the problems faced by out of school youth in developing countries. COL goes on to report that “Open schooling has the potential to meet the rapidly increasing demand for secondary education because it can be conducted at scale and cost-effectively” (COL *Connections*, June 2008).

There are many different views on what open schooling is; however, as defined by COL, open schooling is open and flexible and involves the physical separation of the school-level learner from the teacher, the use of unconventional teaching methodologies and information and communications technologies (ICTs) to bridge the separation and provide the education and training (Rumble and Koul, 2007).

One of the main characteristics of open schooling, however, is that the learners are often geographically separated from the teachers and so do not have ready access to ongoing academic and administrative support. However, open schooling differs from open and distance learning (ODL) in that it is more open and flexible as usually no rules dictate student ages, prerequisites, course content or number of courses in which learners must enrol.

It is well known that ODL programmes suffer from poor completion rates for a number of reasons, namely:

- learner isolation;
- lack of personal feedback;
- technical problems; and
- lack of social interaction.

Because in an open schooling system learners are also physically separated from the teacher, any viable open schooling model must take the associated problems into consideration and include adequate learner support to improve learners' chances of succeeding. Learner support is usually defined as: "enabling learners to study successfully and to develop their own understanding of their learning materials" (Ufi/learndirect and Kineo, 2007).

The British Institute for Learning and Development suggested three forms of student support that should be provided. This includes support for:

- **learner's mediation** with course and learning materials;
- a **social environment** that encourages **dialogue and interactions** between learners and staff and between learners themselves; and
- an administrative framework needed **for management and dissemination of information** to and from students (Ufi/learndirect and Kineo, 2007).

Tait (2000) indicates that the main reasons for having student support integrated in an ODL system are that:

- Students want support (cognitive support to learning).
- It reduces dropout rates (affective support to promote learning and success).
- Learning often needs mediation of some sort (systemic support to help students manage the rules and systems of the institution so as to encourage persistence).

Tait (2000) goes on to say that student support in ODL aims primarily to assist students to learn successfully and recognises that in such a system there is a need to help students with their feelings of confidence and self-esteem and so energise them in ways that would encourage them to be persistent and succeed. The innovative use of ICT-based systems is known to be able to deliver these goals very effectively.

As developing countries continue to explore open schooling models and what such models might mean for their development and implementation in countries that have limited resources, there is a need to explore the suitability of mobile technologies for learner support in open schooling systems. Mobile technologies in this instance refer to wireless technologies such as hand-held PCs, PDAs, mobile phones, iPods, and so on, and these devices are being punted as being suitable for the purpose of learner support. A lot of different mobile technologies are being tested in innovative ways for purposes of supporting teaching and learning both inside a formal classroom and in the more informal arenas of learning. Many such initiatives are even funded by companies such as Nokia, Sony, Sony-Ericsson, Siemens, and so on, whose technologies are being tested in this regard. Many of these initiatives are taking place in more formal learning situations, some in well-resourced educational institutions found in developed countries and more recently trials in less-developed, under-resourced institutions in developing countries. This setting possibly makes it easier for donors to keep track of what is happening and there is some level of accountability.

Whereas many online reports and newsletters give glowing reports of these initiatives, at this point in time there is very little more formally documented evidence of how the use of these technologies are impacting on student performance. This may be because many such initiatives are still in their initial pilot phases, while others seem to have been carried out over too short a period of time for there to be any measurable impact. Adeya (2005) reported that there were lot of pilot initiatives and anecdotal evidence but that it was difficult to find literature assessing issues from a user perspective.

There is a need to further investigate the use of these technologies from the literature as well as from a user perspective so as to gain a more informed understanding of what using such technologies might mean for the development of quality student support in open schooling systems in the developing world.

This report aims to further interrogate ongoing and completed educational mobile technology initiatives so as to determine any lessons learned that might be of relevance in the process of developing quality student support systems for open schooling in developing countries with a special emphasis on Africa. Evidence will also be sought with regards to the perceived or observed impact of the use of such technologies on student performance and their experience of learning in the open schooling system.

METHODOLOGY AND PROCESS

A **desktop audit** was carried out to determine what initiatives are out there and to glean any documentary evidence of their impact on student learning available in journals, online, newspaper articles, and so on. This information was captured in the form of a matrix using the Google and Google Scholar search engines. This was done because it was felt that the Internet was the most likely place where such initiatives would be reported on. Based on an initial analysis of the information available about the various initiatives, 12 categories of information were identified and were used to construct the audit matrix. Twenty one initiatives were identified of which 10 were of South African origin. Others included projects from Kenya, Uganda, Tanzania, Philippines, India, Israel, Finland and the UK.

The audit also helped to **identify those projects that warranted further exploration.** These projects were selected on the basis of a number of criteria listed below:

- The initiatives had to use mobile technology to support learning and teaching in an African context.
- Mainly South African projects were chosen because of their close proximity and therefore ease of access due to the tight project timeframes.
- The chosen project needed to have been running for at least two years.
- The projects needed to be ongoing at the time of the audit.
- Project personnel had to be contactable.

- The project had to contain components that made it suitable for learner support in open schooling.
- The project allowed for the use of basic mobile technologies to ensure accessibility and cost-effective options.

An interview schedule was then developed and stakeholders of the selected initiatives were contacted and interviewed by e-mail, by telephone and where possible face-to-face so as to gain further insights and information about the purpose, outcomes and progress being made on their respective projects. The information collected from the desktop audit and stakeholder interviews was analysed and used to identify those initiatives that were worth visiting so as to gain insights and further information by meeting and interviewing project beneficiaries.

Five initiatives were targeted for further investigation. The information collected revolved around getting a **project description,** identifying the **target community** and **project participants**, the type of **technology** used, issues relating to project **sustainability,** lessons learned as well as **challenges and successes.**

The approach taken was slightly different from that proposed in the initial project proposal. It initially had been envisaged that out of the information collected from telephone interviews a separate tool would be generated for the site visits. However, it became clear from the telephone interviews that a significant amount of information could be obtained by talking to implementers by telephone and that many of the projects were in many instances virtual ones with no available means of tracking beneficiaries so as to get inputs and feedback from them. Also access to the schools in the short timeframes given was going to be problematic as it was school holidays and also one would have to obtain ethical clearance from the Department of Education prior to going into the schools. Lastly, some projects were fairly simple and did not require further investigation through site visits.

Three lengthy telephone interviews were held with some project participants. The questions used for the telephone interviews seemed to generate the sort of information being looked for; therefore these same questions were expanded slightly and used on the different stakeholders interviewed. The site visit questions targeted the following stakeholders: project leader, administrative staff, research supervisors, students and applications developers.

KEY FINDINGS

This section summarises the different findings that arose out of the various activities. Details from each activity can be found in the relevant appendices in the main project report (SAIDE, 2008).

Information collected varied considerably across different projects, ranging from superficial descriptions to detailed reports. There could be a number of reasons for this. In some instances the projects were still in their infancy and so not much was available about them.

OVERVIEW OF MOBILE TECHNOLOGY USE FOR LEARNER SUPPORT

The following initial findings were made from the desktop audit:

- The initiatives range from those that are institutionally based to those that are virtual; however, the majority are located in institutions.
- Most projects used mobile phones but others used other hand-held devices such as e-slates and PDAs (for example, EduVision). In addition, two of the initiatives (*Digital Doorways* and *Hole in the Wall*) used "tethered technologies" but were considered to be useful for open schooling as these technologies were placed in rural areas and were openly made available to those who wished to use them whenever they wanted to.
- Five of the projects focus on high school students and, in particular, on the subject of Mathematics (for example, Dr Maths on MXit and MLearner Mobile).
- The mobile devices were used for other subjects like Biology (two projects: MOOP and MobilEd) and languages (for example, MELFA and MobiDic) but these were in the minority.
- Some of the projects focused on student administration and academic support of mature distance education learners in tertiary institutions (for example, initiatives at Makerere University Mobile Research Support Initiative (MRSI), University of Pretoria and the Dunia Moja Project).
- Other subjects covered were of a more general nature and revolved around literacy, numeracy and basic science aimed mainly at primary scholars (for example, BridgeIT).
- Two of the projects were aimed at teacher development and upgrading of teaching skills (for example, SemaKenya and DEEP).

- The One World M4G (Mobile for Girls) project is a for-profit project that focuses on health education, jobs and lifestyle information and tips aimed at low income earners in Kenya. However, most of the projects are not for profit.
- In some projects parts of an offering are free but to get full functionality and access to everything fees of some sort have to be paid (for example, full access to Mobi Maths requires the payment of a monthly fee of R30).
- Most of the projects are made possible by and involve Public Private Partnerships.
- A few projects like the MRSI and MLearner Mobile are implemented and funded by a small group of private individuals and receive little, if any, financial or other external support.
- There were three different project funding arrangements:
- donor or corporate funded;
- institution itself funds the project (self-funded); and
- not funded (individuals incur costs and time in their private capacity).
- Some of the systems are focused on information retrieval and download. Other systems make available information that is mediated either for purposes of learning or passing on important administrative information. In some projects mobile phones are used to collect information and encourage co-operative learning and knowledge creation.

However, in general the desktop audit was not sufficient to generate the sort of information that would enable one to make recommendations about using mobile technologies for learner support.

LESSONS LEARNED FROM THE SELECTED MOBILE TECHNOLOGY INITIATIVES

This section provides a summary overview of the three South Africa–based projects and the one Ugandan project that were drawn from the desktop research study based on their potential for adaptation and use in open schooling environments.

Four projects with potential for use in open schooling were targeted and people involved in these projects were contacted and then either interviewed by telephone or face-to-face. These included MLearner, Dr Math on MXit and MobilEd and MRSI at Makerere University.

All four projects use the mobile phone to support educational processes. While most programmes use basic mobile phones, some use mobile phones with Bluetooth capability. What is clear is that basic phones can be used to provide students with support and allow them to access information. However, the nature of that information is limited in terms of amount of text as well as type (it often excludes graphics, and so on). Some projects combined the use of the mobile phones with computers and servers to add an extra dimension. For example, at Makerere one of the ways in which students can receive messages is from e-mail to SMS. For MLearner Mobile and Dr Maths on MXit the phones used were able to download software so as to gain full functionality.

The projects generally provide students with a range of services. These vary depending on the sophistication of back-end technology and the capabilities of the mobile phones used in the project. All the projects involve some sort of human mediation. The mobile phones (depending on the particular initiative) were being used to varying extents:

- **access** learning and course materials (MLearner Mobile);
- **mediate** with course and learning materials (Dr Maths on MXit);
- create a **social environment** that encouraged **dialogue** between learners and staff and between learners themselves either directly or with the aid of chat room software (MLearner Mobile, Dr Maths on MXit, MRSI);
- encourage collaborative learning and the creation of new knowledge (MobilEd); and
- provide administrative support for the management and dissemination of information to and from students (MRSI).

These characteristics of the initiative are in-line with the recommendations made by the British Institute for Learning and Development about the types of learner support that should be provided in ODL system.

The mobile phone is clearly invaluable in terms of providing a platform through which students can communicate with their teacher and other students. This includes receiving information on issues such as when they are writing tests and reminders about assignment deadlines.

Communication also involves one- and two-way relationships between learners and others and revolves around sharing of academic and administrative information but is also about supporting students in other ways; for example,, providing morale and encouragement and, most importantly, removing alienation and loneliness which students often feel. Specific examples of the ways in which mobile phones were used in the various projects are given below.

ACCESSING OF LEARNING AND COURSE MATERIALS

- accessing of downloadable digital information ranging from definitions to short paragraphs or even page downloads from books or manuals;
- sending and receiving of information in text form; and
- sending of information and responding to queries in text form and receiving audio feedback (real or synthesised).

CREATING A SOCIAL ENVIRONMENT THAT ENCOURAGED DIALOGUE BETWEEN LEARNERS AND STAFF AND BETWEEN LEARNERS THEMSELVES

- communication between learners and teacher or supervisor either through text or voice calls.
- communication between learners either through text or voice calls. and
- learners and supervisors using mobile phones to communicate via a server linked to Web sites or even radio podcasts.

MEDIATION WITH COURSE AND LEARNING MATERIALS

Provision of **academic support for learning** using mobile phones was provided in mainly two forms and was usually focused on providing homework or coursework support; for example:

- access to content and other information that would otherwise be unavailable;
- two-way communications through either SMS or voice calls to support students' requests for assistance or to help with pacing with regards to completion of a particular task; and
- accessing exercises or tests for study and review.

PROVIDE ADMINISTRATIVE SUPPORT FOR THE MANAGEMENT AND DISSEMINATION OF ADMINISTRATIVE INFORMATION TO STUDENTS

Mobile phones were in use for informing of test dates and deadlines; for example, helping the learners to learn about and deal with the complex administrative structures and processes of the institution (for example, Makerere University, MRSI). This was in the form of:

- text messages from phone to phone; and
- text messages from computer to mobile phone (e-mail to SMS).

ENCOURAGING COLLABORATIVE LEARNING AND THE CREATION OF NEW KNOWLEDGE

Students were encouraged to collaborate on projects through using mobile phones to:

- communicate and provide support for each other by text or voice calls;
- share information using Bluetooth;
- collect and capture data in the form of pictures; and
- upload or add revised or newly created information (in the form of text and graphics) onto specified Web sites.

However, despite the fact that mobile phones facilitated quick and easy communication between learners and their teachers or lecturers, there are certain potentially problematic aspects of this communication that need to be interrogated further to gain a better understanding of how the technology can be used and range of guidelines and protocols need to be developed to ensure that communication.

Examples of some of the challenges that arose out of using mobile phones for learner support in the various initiatives are discussed below:

- With regards to effective communication, students at Makerere reported that while being able to access their lecturers by mobile phone was a convenient facility and made them feel closer when contact was made, they also indicated that the actual process of establishing contact was sometimes not easy; for example, if they called and the call was terminated, they would be left wondering whether and when to call again. Sometimes they were not made aware of why the call had been terminated leaving them feeling "unsettled and unsure" of how to proceed. In the same vein staff was often inundated with calls and SMSs from students some at very inconvenient times resulting in information overload and cognitive pressure as well as generating potentially uncomfortable situations for both student and lecturer.
- Timely communication is critical to proper functioning within an open schooling or distance education system. Learners in some initiatives expressed frustration at not

receiving or receiving delayed feedback or support when they needed it; for example, this was a problem experienced with MLearner Mobile users. This can impact on student motivation and the student's ability to persist and complete a task.

- Security issues can be a big problem and appear to pervade systems that are more organised around particular institutions rather than across institutions; for example, students from University of Pretoria that provide the homework support for learners are in a position that could result in abuse and improper relationships between tutors and learners resulting in the need for training in how the interactions should take place, as well as the installation of some form of monitoring system. However, if students are located across the country it may be more difficult to cause such harm than if they are located in particular institutions. It must also be noted that many students use the service to ask for psychological help for which the people that are implementing the projects are not trained.

- Some students on the MRSI indicated that there were sometimes problems when calling lecturers of the opposite sex who felt their privacy was being invaded and the fear that partners would get upset if they misunderstood who had called and the nature of the calls.

- Others MRSI students indicated that whereas phones served to bring them "nearer or closer" they felt safer being at a distance "unseen" by their lecturer as they felt that being seen could possibly lead to "bias" or "discrimination." Clearly there was an element of fear or aversion to making direct contact. Staff on the programme also reported "student avoidance" with regards to being contacted whether directly or indirectly.

It is clear that some research has to be done about understanding the dynamics of interaction using mobile phones for learner support as it clearly can impact on how the users feel and therefore how they behave. This could impact somewhat on one's ability to learn successfully.

SUSTAINABILITY

Projects that are being supported by resources from donors were found to have better capability in terms of technology and human capacity. These projects also showed greater availability, consistency and quality in the provision of learner support. All these contribute towards increased viability and sustainability.

Basic mobile phones are relatively cheap in comparison to other hand-held mobile technologies such as iPods, PDAs and some of the sophisticated phones that have all sorts of capabilities and function rather like miniature computers. Since most students involved in the various initiatives

own fairly basic mobile phones, this provides a framework for sustainability as costs can be kept at a minimum. However, in a number of self-funded projects, team leaders such as teachers do not have resources for the ongoing running of projects, which threatens sustainability, for example, MLearner Mobile (no funding support) and the MRSI (very limited financial support). This situation impacts on the ability to up-scale such projects as there is no room to increase human resource capacity or improve the systems further.

In the case of Mlearner Mobile, the support is on a volunteer basis and teachers perform services on an ad hoc basis when they have the time. This approach is clearly not sustainable and results in infrequent and ad hoc communication and support to students. Furthermore this approach forces teachers to use their private resources for the project, which cannot be sustained over time. The quality of support that can be offered is therefore questionable as often it is neither timely nor of a sustained nature.

The situation at Makerere on the MRSI is slightly different in that there is an "incentive" to participate as research supervisors are paid extra compensation for every student that successfully completes their research project. However, this does not change the fact that they have to pay money out of their own pockets to facilitate the research process and yet there are no guarantees that a student will pass. There is limited institutional financial support despite the initiative being seen as innovative. This is because the institution is cash-strapped and therefore at this point in time the MRSI is not seen as a priority.

In the case of the Dr Math on MXit, there is a strong partnership between the University of Pretoria and the Council of Scientific and Industrial Research (CSIR), which ensures the project's sustainability. The university offers volunteer tutors on the project who have to complete community service in order to graduate. The CSIR provides the offices and computers for tutors to provide the feedback to students and gets to carry out research on how the system is used and how it might be further improved. The research component of the project has the potential to attract further funding from both internal and external funders. This represents a potentially sustainable model of using mobile phones to support students.

Another issue that could impact on project sustainability and future developments is the problem experienced at Makerere where because the students and staff use their own phones. This situation has the potential to impact negatively on future planned developments as they all own different phones with different capabilities and are linked to a number of different mobile phone networks. Such a problem could be overcome by making the phones and integral part of the students' study package and therefore advocating for the buying and use of a particular kind of

phone accessing one network. This would also enable software developers to synchronise their applications to these devices. However, this approach of course has cost and other implications.

It is clear that project sustainability especially in under-resourced developing countries is dependent on the formation of strongly synergistic Public Private Partnerships to provide various types of support to such initiatives thus ensuring an element of sustainability, the BridgeIT project in the Philippines is another good example of this. However, as a lot of these initiatives are still in developmental and exploratory stages extra funding could also be accessed by linking project activities to research.

Lastly, it was clear from the various discussions held with stakeholders involved in the MRSI that the extent to which the use of mobile technology is formally integrated into the distance education courses and becomes an integral part of programme delivery contributes to increased sustainability of the initiative. But right now there is no evidence that this initiative is sustainable for a number of reasons. These being as follows:

- The initiative is based on a spirit of "volunteerism."
- There is still a lot to be learned as the initiative is still relatively new.
- There is no significant funding available at present to support its integration and possible up-scaling.

These factors do not only impact on sustainability and scalability but also limit impact.

TEACHING AND LEARNING

At this point in time as people continue to explore the use of technologies, there is insufficient evidence in the initiatives investigated, of how the mobile phones are used to support teaching and learning (in terms of pedagogy). There is no doubt that students can access information that they require. There is also evidence that the phones can be used to support homework by providing feedback on basic problems. The extent of support in this regard is limited by the technology; for example, some technologies do not allow for graphs, tables or diagrams.

There is evidence that use of the mobile technology has encouraged more active learner participation in the learning process with learners taking charge of their learning and also supporting each other and collaborating on projects and tasks in a meaningful way. Use of the technology also provides opportunities for the collection of data and the creation of new knowledge that learners and their teachers can make available to others. The MobilEd project is a

good example of this. However it should be noted the information generated by learners that is up-loaded onto sites like the Wikipedia site is not necessarily checked thoroughly raising questions and the quality of information generated. This can be disadvantageous.

In Finland, Mattila and Fordell (2005) reported that students using a mobile phone to analyse surroundings and to communicate within groups were encouraged to participate in inquiry learning and creative problem solving. Their model involved learner-centred collaborative learning that was teacher supported. The pedagogical principles involved inquiry learning, skills for gathering information and building knowledge, creative problem solving leading to interactive and co-operative learning. The MobilEd initiative has somewhat similar characteristics in this regard.

There are also limitations in terms of support that can be provided in supporting students to understand newly introduced concepts especially at primary and secondary school level unlike at tertiary level where students are expected to able to learn pretty much on their own. In all likelihood this would need to be mediated in face-to-face sessions. Finally, there are also limitations with the use of the technology to diagnose exactly where students are having difficulties and how they could be dealt with. For instance in solving a geometry question, it is difficult to understand and explain where the student has gone wrong in a 20-step process using mobile phones. Also some subjects are more amenable to delivery and support using this technology than others.

There is a definite need to further interrogate and carry out research into the different pedagogic strategies required to bring about the development of effective conceptual and other higher order learning skills when using mobile technology for learner support within an African context.

Effective uses of mobile phones for learner support at the moment seem to be:

- support for home work;
- access to relevant information;
- access to test banks;
- sharing what they've learned with others;
- creating new bits of knowledge; and
- data collection.

Traxler (2005) in his report on the strategic aspects of wireless and mobile learning pointed out that wireless and mobile learning are usually implemented as enhancements or extras to core provision, often as a variation of conventional e-learning rather than as a new form of pedagogy. The most exciting, innovative and convincing examples of wireless and mobile learning are projects where new forms of learning are created, rather than where existing forms of learning are re-versioned and ported, but these are most problematic in terms of institutions being able to guarantee the standard and quality of learning for their students.

COST

It is evident that since many projects are in their initial stages of development, there is little focus on or understanding of cost implications at this stage. Also where there are partnerships for back-end technology development, it is unclear what the nature of these costs are as the technologies are new and are therefore in a continual process of development. What is clear is that in some projects, such as MLearner Mobile and MRSI teachers bear the brunt of the costs and this situation threatens the success of the project. There is a critical need to do some cost-benefit research to gain a better understanding in this regard. The University of Pretoria initiative being one that is now firmly integrated into the university system is possibly one that could be investigated to gain an understanding of the costs associated in its implementation.

IMPACT OF PROJECTS

One of the challenges that emerged in these projects is that it is difficult to evaluate the impact of projects that run across institutions. This is because many of these projects do not have tracking systems, partly due to security reasons and partly due to the low capabilities of the back-end technology. Innovative ways of seeking information about this must be found. Another problem was that many of the initiatives were still too new and not enough information had been gathered about them as yet.

There is clearly a need to identify some of the more sustainable and enduring projects so as to study them further over a longer period of time.

SYNTHESIS OF FINDINGS

This brief study indicates that there are projects out there providing support for learners using mobile technologies. A few like the mobile technology for student support project at the University of Pretoria are pretty firmly entrenched in the system and there is ongoing active research linked to the initiative. However most initiatives seem to be in their initial testing phases

and would need further in-depth exploration to gain a better understanding of the intricacies involved.

Initial findings indicate that there is definite potential for using mobile phones in various ways to provide learner support in the African context. Mobile phones are being used in a number of developing countries in this regard. On the recently initiated Dunia Moja Project under- and post-graduate students based at three Universities in Africa collaborate via cellphone with students at Stanford University. The students can watch or listen to presentations loaded on their mobile phones. They have sophisticated mobile smartphones with video cameras, audio recorders and Internet capability that were donated by Sony Ericsson. The students also have access to a moblog which is an online interface which sends postings to mobile phones. Students can also view their materials on a CD. They can text, send images and make phone calls while class is in session and issues can be debated through the Internet. They are able to communicate with leading experts in different countries. Students share course materials, exchange information, contribute course content and help design collaborative activities. While this is a very exciting initiative, it raises questions of sustainability and scalability as it uses a wide variety of strategies and technologies that would probably prove to be very costly to implement in a developing country context unless supported heavily through finance and technology.

A variety of simpler technology strategies (some that combine different technologies) are being used that involve enhancing communication between learners and teachers that are geographically separated. The types of communication vary from simply sending and receiving of academic or administrative information, to providing mediated academic support; for example, for completion of homework or providing pointers to useful information, helping to pace or motivate a student, and so on. Such communicative support has been reported as being successful in helping support and direct students so that they persist and complete assigned tasks.

The technology used seems to consist mainly of one of three types of mobile phone:

- basic mobile phone requirement (no connectivity);
- basic mobile phone Java or GPRS enabled (with connectivity); and
- mobile phone with Bluetooth capability (ability to transfer information between two phones near each other).

The phone capabilities impact on the way they can be used to provide support with the more sophisticated phones being able to do more but are substantially more expensive. Very few

young people in Africa have access to such fancy phones. This means that in under-resourced situations many services offered by interventions are limited by the phone capabilities.

The phones are often linked to other technologies such as computers and servers, as well as relevant mobile phone software. There are challenges with this such as issues of compatibility between the different types of technology as well as the different software formats and platforms. Other challenges faced are those relating to network connectivity and downtime. In many rural areas mobile phone networks and electricity are variable creating difficulties in that there is no consistency in such services. This can impact negatively on delivery of student support services using mobile technology and needs to be taken into consideration when planning such interventions.

The back-end technology support tends to be of two types: (1) it can be a centrally driven government or research agency supported system or (2) it can be a volunteer system. The government or research agency supported system is often quite sophisticated. Implementers are usually able to experiment and explore more as there are dedicated funds and capacity available. An example of this is the MobilEd and the Digital Doorways projects. However, the volunteer system as seen in the example of the MRSI and MLearner Mobile projects often arises out of an individual's passion or dedication towards an intervention but in some instances people that are then co-opted to help implement are not necessarily dedicated, creating a system that is unsustainable due to lack of available incentives and other institutional or external support.

Mobile technology has been used for purposes of teaching and learning in the following ways:

- supporting resource provision and access to information;
- collecting data for projects;
- creating new knowledge;
- encouraging collaborative learning;
- encouraging active learning;
- pacing students; and
- motivating students.

At the University of Pretoria mobile phones are being used to provide asynchronous academic support in the form of questions via SMS with feedback; phone in to listen to mini lectures using

interactive voice response technology; interactive multiple choice quizzes; directing to specific resources for specific tasks via SMS. These SMSs are classified as:

- *Academic* — instructional;
- *Academic* — interactive;
- Student questions — interactive;
- Interactive voice response (IVR) — mini lectures; and
- *Lecturer response* — instructional.

Viljoen et al. (2005) from the University of Pretoria are of the opinion that the successful use of technology to support student learning depends equally and critically on the ability of their educators to design and develop didactically sound m-learning opportunities and environments.

There are of course limitations to what can be achieved using a mobile phone due to its small screen and in some instances limited capabilities — some are limited to text only; others have limited graphic and colour capability. Other more expensive ones have camera and Internet capabilities. This also means that the mobile phone is not suitable for use with regards to teaching and learning of certain subjects or processes and yet is suitable for use with others. Most projects investigated involved using mobile phones to support learning of maths. This is probably because the set-up of such a phone lends itself more easily to a maths exercise than it might for a biology or history essay. However, it is clear that in whatever way the phones are used information can only be passed on in small packets.

Available information on research and evaluation of mobile technology interventions is rather limited at present with the exception of initiatives like that at University of Pretoria. This is probably because many interventions are still in their early developmental stages and have not progressed far enough to warrant an evaluation. Some projects are difficult to evaluate because they are virtual and/or have a security component to protect young learners and so cannot be easily tracked. Institutional based interventions are easier to evaluate but do not provide as much information that can be transferred to an open learning context at this point in time. There is a definite need for more in-depth research to gain further understanding in this regard.

There is no clear information regarding costs and benefits associated with the running of the different initiatives. This is partly because most are in their initial stages and are focused on testing the technology. However, most projects that have been able to scale up are supported through Public Private Partnerships. What we do know is that in some interventions educators

have often had to pay their own bills associated with the initiative which they are not keen to do. This situation impacts negatively on the potential for any such initiative to up-scale or even become sustainable. In such instances there is the need for incentives and other support to help maintain the projects. Cost is an important aspect of any interventions to be undertaken in an under-resourced context.

This means that it is imperative that more long-term research be carried out to further understand the actual cost implications as this has an impact on project viability and sustainability.

Traxler (2005) summarises the situation quite succinctly by saying:

> Current projects in wireless and mobile learning are mainly 'first-generation', meaning that their focus is frequently on making the various technologies work, ensuring learning happens and satisfying funding conditions. These projects do not usually address issues of scale, embedding or quality, and technical challenges often squeeze the time and resource available for evaluation. Consequently identifying explicit and objective improvements or costs can be problematic.

At this point in time, not enough long-term information is available to make informed decisions about developing models using mobile technologies in open schooling systems. Of the African initiatives studied, the University of Pretoria and the MRSI "models" have many components that would be relevant within an open schooling context, it is initiatives such as this that might warrant further research to gain further understanding. Interestingly, there is some evidence that the University of Pretoria project is replicable to a limited extent as the MRSI initiative evolved from it. However, it has not been possible to completely replicate it due to the fact that Makerere is acutely under-resourced in comparison. Other initiatives such as BridgeIT also need to be further investigated as they seem to have been very successful and scalable.

More in-depth research is required into the various issues raised out of this study. What is clear is that a model would need the integration of appropriate technologies with quality programme delivery. This means that there would be a need to first develop a suitable open schooling model and in developing it ensure proper integration of the technology to provide quality learner support within a properly contextualised framework.

USING MOBILE TECHNOLOGIES FOR LEARNER SUPPORT: THINGS TO CONSIDER

Ideally any agreement to use technology should preferably be integrated into initial planning, policy and strategies of the programme or institution to achieve systemic integration. However in light of the fact that use of mobile technologies for supporting teaching and learning in developing countries is relatively new and not clearly understood at this time, one could go for a more step-wise research focused approach but must be fully aware of the constraints and limitations of using non-systemic, non-integrated approaches as often the researchers or individuals involved in such initiatives move on and the developments may never be consolidated.

The Joint Information Systems Committee (Jisc) Is An Organisation Based In The United Kingdom Whose activities support education and research by promoting innovation in new technologies and by providing support of ICT services. This organisation has developed tools that can be used to help institutions, managers and education practitioners plan for the use of mobile and other wireless technologies within a system. The institutional tool can be used either for an institutional audit or planning for future provision. This tool also has a matrix that can be used to ensure processes are in place for continuous monitoring, quality assurance, organisational learning and improvement. These tools can be found and downloaded from www.jisc.ac.uk/publications/publications/pub_innovativepe.aspx.

Initial interrogation of the tools indicates that they are very relevant and can easily be adapted for use in different contexts.

The **institutional tool** recommends that the following areas need to be considered before attempting to implement the use of mobile technologies in an institution:

- learners and their experience of learning;
- pedagogic culture and expertise;
- infrastructure, and
- organisational strategy and vision.

In this instance the institution can be a whole institution, department or faculty or a smaller body such as a programme team.

The **practitioners' tool** covers the following areas:

- learners and their experience of learning;
- learning and teaching;
- technologies and infrastructure; and
- planning for skills development.

The **manager's tool** focuses on:

- providing functionality and procurement;
- managing the devices; and
- setting up or extending a wireless network.

While it is clear that these tools were developed within the context of well-resourced institutions they definitely are a good starting point for adaptation and the development of a tool that might be useful to help support the development of innovative practice using mobile technologies for learner support in a developing country context where access to resources is likely to be a major constraint. This could be done also taking into consideration some of the preliminary but important findings that have been made in this study such as:

- The need for guidelines and protocols to **ensure the technology is used effectively for teaching**. That the teaching and learning using the devices is effective, timely, safe (that is, both health and personal safety), respectful and comfortable for all participants.
- There is a need to build in features that would ensure **sustainability** by doing the following:
- allocating funds and setting budgets;
- developing synergistic Public Private Partnerships; and
- securing funds for development and innovation by linking project to research outputs.
- There is a need to develop a clear **understanding of what it is going to cost,** for example, what the costs are relating to:
- technology functionalities such as software development and hardware development;

- content development;
- human resources required to develop, implement and maintain;
- usage costs for the project and the user (for example, phone, download, connectivity); and
- teaching costs.

In conclusion, while there clearly is a need for further in-depth research and interrogation into how mobile technologies can be meaningfully, fruitfully and cost-effectively used for learner support in an open schooling system within a developing country context, this should not necessarily serve as a deterrent to starting to implement mobile technology learner support initiatives. There are available some tools and guidelines that could be adapted for use within the developing world context. Such mobile technology initiatives should be investigated and developed alongside or aligned with existing moves to develop functional open schooling systems in order to make them relevant and an integral part of the whole system.

NOTE

This chapter is an edited version of the project report entitled "Using Mobile Technology for Learner Support in Open Schooling" prepared for the Commonwealth of Learning by A. Barlow-Zambodla and F. Adams of the South African Institute of Distance Education (SAIDE). The full report is available at http://www.col.org/SiteCollectionDocuments/Mobile%20Technology_Final%20Report.pdf (accessed 18 June 2009).

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CHAPTER 3: USING MOBILE TECHNOLOGY FOR LEARNER SUPPORT IN OPEN SCHOOLING: A EUROPEAN PERSPECTIVE

INTRODUCTION

The purpose of this report is to identify and highlight areas where mobile technology is being used systematically for learner support, where information about cost and effectiveness is available and where activities might be transferable in support of open schooling.

Addressing these questions is not straightforward and raises issues that will be discussed in this introduction. Definitions of mobile technologies and of learner support are needed at the outset. This in itself is difficult given the speed of change, especially in the technological field, and those definitions are given in the next section.

There is a multiplicity of ways in which mobile technologies are becoming either the main vehicle of the learning process or one of its integral parts, and these are described in the body of the report. The literature abounds with examples of small projects which use mobile technologies in part and which report on student reactions. Small screens and small keyboards are a limiting factor that does not seem likely to be resolved by innovations such as fold-up and projected keyboards or screens. These obstacles gives strength to the argument that new pedagogies are required rather than simply transferring what is currently available online to a hand-held device. Such new pedagogies are beginning to appear and involve bite-sized learning opportunities, with graphics, quizzes and a restricted amount of text. They provide opportunities to receive or report information from work-based or other locations.

As with all new technologies there is a great temptation by “early adopters” to acquire technology first before thinking through how this might be used to benefit students. As Arthur C.

Clarke (quoted in Guri Rosenblit, 2009) commented "when it comes to technology most people overestimate its potential in the short term and underestimate it in the long term." Indeed, "distance education development is littered with examples of how expensive technology has been introduced and then not used or not used to capacity" (see Mills et al., 2005). The best mobile technology developments have avoided this pitfall. In this report we have identified examples where the pedagogy of a particular programme has been enhanced by the use of mobile technology and where learner support is provided in a manner which is not readily available through other means.

The quality of the learning experience provided by mobile technologies is of vital importance and student views should form a key element of any evaluation. We give some of the results of evaluations based on student feedback where these have been significant and/or substantial. As Lord David Puttnam (2008), chancellor of the OU UK points out "failure arises from decisions made by people in their 50's to be implemented by those in their 30's and 40's for people in their teens and 20's." Early adopters are vital to any development but their enthusiasm should always be tempered by evidence that students actually find that their learning is enhanced.

The estimation of costs is also problematical: there is very little in the literature about costs which are so context dependent as to make it difficult to extrapolate from one situation to another. Costs also depend on whether the hardware is loaned or owned by the student. In the UK, this very often depends on major investment by the government or by companies who have a community remit. One finding of this report is that when students and parents are subsidised by government or other funding so that they take ownership of the devices, there is minimal damage or loss to equipment.

The advantages of mobile technologies in Europe, however, are very evident. At least in theory, they enable "learning anywhere, anytime." This is an attractive slogan and the delivery of content — text, videos, podcasts, and so on, through PDAs and smartphones is seductively straightforward: send out the video of the professor's lecture and the "tyranny of distance" is overcome. The BBC has recognised the potential popularity of general certificate of secondary education (GCSE) revision via mobile phones (for example, with several alternatives available from www.bbc.co.uk/mobile). These include 150 revision questions for GCSE English, maths and science, daily quizzes and MP3 audio revision guides which can be downloaded straight to selected mobiles.

Interestingly, Nikoi and Edirisingha (2008) show that learner support is also required "anywhere, anytime." Their work highlights the importance of technical as well as other kinds of support and

demonstrates the role of partners, children, fellow students and friends in providing such support.

Logistically, for institutions, the provision of learner support “anywhere, anytime” seems more challenging than the provision of content. This is an area where “self-help” rather than institutional help might be most appropriate.

The flexibility provided by mobile technologies can be valuable as additional support and convenience to students who already structure their learning with the aid of institutional learning management systems; but more importantly it can be the best way of teaching in particular environments (for example, field work and other context-based learning experiences and in particular, work-based learning).

In many cases, however, mobile learning, through PDAs and mobile telephones may provide more than additional activities and be the only way in which many students can access both content and learner support. These may be of particular relevance to open schooling. We comment on all these possibilities in this report.

Finally in this introduction it is worth commenting on the argument that the use of mobile telephones “leapfrogs” the need to have PC-based systems. A direct consequence of the development of G3 and G4 phones and smaller, more portable PCs is that access to the Internet “anywhere, anytime” is becoming the norm. The convergence of “mobile” and “PC-based” systems within European contexts therefore makes distinctions about usage more problematical with reference to developing countries where access cannot currently be assumed.

If the costs of hardware and connection charges continue to be reduced, with governments in the South being prepared to challenge the prices charged by telephone companies, this convergence may lead to portable connected hand-held PC devices which probably would be cheaper than a smartphone.

The only advantage of a phone would be in those situations where the phones are very much cheaper to buy or rent and where SMS messaging and oral communication can be used effectively in learner support. Many of the mobile learning projects in the school sector in the UK have enabled learners to access learning and support in their own time. This is particularly true of those that are SMS based and utilise *learner-owned technology*.

The dependence of citizens today on mobile telephony in every country of the world is demonstrated by a 2007 study carried by the London School of Economics for the United Kingdom company, Carphone Warehouse. The major findings are striking and surprising:

- One in three people would not give up their mobile phone for a million pounds or more, with women leading the way on those most likely to refuse.
- 76 per cent of people believe it is now a social requirement to have a mobile phone.
- 85 per cent of people think having a mobile phone is vital to maintaining their quality of life.
- One in five 16- to 24-year-olds think having a mobile phone increases their quality of life.
- Most young adults who took part in the ethnographic experiment felt mobile phones were not just a tool, but a critical social lifeline for feeling part of a friendship group.
- Most of 16- to 24-year-olds would rather give up alcohol, chocolate, sex, tea or coffee than live without their mobile phone for a month.

Source: The Mobile Life Youth Report, 2007

DEFINITIONS

MOBILE TECHNOLOGIES

Attewell (2009) (MoLeNet) proposes a definition of mobile learning as follows:

The exploitation of ubiquitous handheld (or very portable) hardware and wireless mobile learning networks to facilitate, support, enhance and extend the reach of teaching and learning.

There is much technical literature on the range of mobile devices and their functionality but these are changing so quickly as to make reporting on the detail redundant. One main distinction is that between devices which rely on telephone access only, for the receipt and transmission of voice or SMS data and those which, in addition, have access to the internet. As noted, with the new generations of G3 and G4 mobile phones these technologies are merging in many European contexts.

However, in developing countries such as Africa the advantages of mobile telephony are the support of those students without internet access of any kind, who cannot afford a G3 mobile

phone but who can, through a simple mobile phone, send and receive SMS messages and make telephone calls quite cheaply.

LEARNER SUPPORT

While learner support can be characterised in many ways, a broadly acceptable definition is that of Tait (2000) who describes learner support in ODL as "the range of services both for individuals and for students in groups which complement the course materials or learning resources that are uniform for all learners" (p. 289).

Tait argues that learner support covers three main functions:

- 1. *cognitive*: supporting and developing learning through the mediation of the standard and uniform elements of course materials and learning resources for individual students;
- 2. *affective*: providing an environment which supports students, creates commitment and enhances self-esteem; and
- 3. *systemic*: establishing administrative processes and information management systems which are effective, transparent and overall student-friendly.

This provides a framework for examining the use of mobile technologies in Europe and for reviewing how far and how successfully they fulfil these learner support functions.

OPEN SCHOOLING

Open schooling can be defined as an alternative system of education at pre-degree level that provides learners with options for learning that are not limited to traditionally timetabled classroom hours covering a standard course duration and that have time and/or location flexibility. Open schooling therefore attempts to improve access opportunities and address a variety of teaching and learning styles (Mitra, 2009).

This concept is not widely used in Europe although there is a European Distance and eLearning Network (EDEN) open classroom group. However, there are some examples of schooling for children who are unable to take part in a conventional face-to-face environment for reasons of geographical, social or other forms of isolation (for example, hospitalised, children of military families and those who are excluded as a result of disruptive behaviour). The recently established

EU project *ComeIn* is looking at the possibilities of mobile technology support to marginalised young people across Europe.

METHODOLOGY

The study has used the following methodologies:

- A desktop audit (using Web search engines) identified sources of good and relevant practice which were captured in a matrix.
- Based on this audit, further investigation of current and future activity and research in the area was undertaken by information gathering at relevant European conferences, such as EDEN, Paris, and British Education and Training Technology (BETT), London.
- Expert consultant input was received from Merritt Associates.
- Projects were identified that warranted further exploration as case studies or site visits covering The Open University, The Mobile Leaning Network (MoLeNET), Tribal-CTAD, Learning2Go, Learnosity, Corvinus University, Budapest.
- Visits and interviews were conducted for in-depth exploration at Learning2Go, The Open University and Cambridge Tribal-CTAD.

Case studies and site visits were selected on the basis of the following criteria:

- They used mobile technologies to support learners in Europe.
- They were well established and used mobile technologies at scale rather than being small-scale, short-term projects.
- They provided evidence of impact on learning through evaluations, publications, and so on.
- They developed software and provided consultancy services to institution.
- They were undertaking significant research in the field of mobile technologies.

KEY FINDINGS

This is the core of our report and distils the vast range of information obtained from discussions (telephone and face-to-face), from Web audits of institutional practice and from literature searches. It covers a classification of mobile technology for learning with examples of its use.

A CLASSIFICATION OF THE USE OF MOBILE TECHNOLOGIES FOR LEARNING WITH EXAMPLES

Mobile technologies in education can be classified in many different ways (for example, by hardware, by level of education, by country, by level, and so on). For the purpose of this report we will use a classification based on the range of ways in which these technologies are used in education at all levels.

It seems useful to make the following distinctions as to how mobile technologies are used for:

- simple (but important) administration;
- monitoring student progress and being proactive to encourage students;
- retention support;
- learner support;
- delivery of course content;
- teaching "niche" subjects (for example, languages);
- quizzes and games designed to enhance learning;
- context-specific activities (for example, museum visits) and as a tool to enhance;
- classroom learning;
- whole course delivery, including assessment and accreditation;
- work-based and just-in-time learning; and
- disabled and institutionalised learners.

ADMINISTRATION

There are a large number of examples of how SMS text messages can be used to provide information of an administrative nature and to give students (and parents of younger students) a greater sense of their links with the institution concerned. The University of Pretoria used bulk messaging to provide basic administrative support and Brown (2005) reports some major successes: in response to a reminder for registration, 58 per cent registered before the closing date compared to the normal expectation of below 40 per cent. He concludes that "mlearning is the

gateway to e-learning for most learners in Africa as the rapidly growing wireless infrastructure increasingly fulfils their access needs."

MONITORING STUDENT PROGRESS AND THE PREVENTION OF DROPOUT

There is important evidence from the Open University UK that telephone contact can aid student retention and persistence. While in this institutional context it was undertaken through landlines the direct and personalised nature of the communication is replicable through mobile devices. The key issue here is that the institution must have the necessary systems in place to be able to monitor the progress of individual students both on individual modules or courses and as an overview of their student career. After pilot studies, the Open University UK has introduced a systematic approach to making proactive contact with students at several points in their student journey and this forms a key element in the University's Learner Support Framework.

LEARNER SUPPORT

SMS messaging is used to provide students with advice on study skills, time management and examination preparation. More sophisticated mobile devices, PDAs and smartphones, are used for diagnostic quizzes, to help examination preparation as well as a range of more interactive exercises to help with study skills (for example, at Learning2Go).

Some institutions (for example, NKI in Norway) offer a service where the whole of the learning management system, available as standard on laptops or desk computers is also available though mobile telephones. This service is welcomed by students who find it convenient to have 24-hour access to the learning management system, which provided access to course content, PowerPoint slides of lectures and self assessment tests, and so on. Such a provision is a useful addition to an already well-developed online service but cannot be regarded as something to which open schooling in developing countries might aspire in the short term. Much more relevant to open schooling is the use of mobile telephones to supply purpose designed learning materials, with self assessment in short modules. This can is best demonstrated by the work of Tribal-CTAD (see Appendix 4, CDEC, 2009).

THE OPEN UNIVERSITY: SUMMARY OF SOME KEY FINDINGS

Proactive contact by the institution or a student's tutor has been shown to have a significant impact on student success. Large-scale research projects involving thousands of students, with the use of control groups, have demonstrated that proactive contact, undertaken by telephone in most cases:

- Before course start can improve end of course retention by 5–7 per cent.
- Mid-course can improve end of course pass rates by 30 per cent.
- After course end can improve student re-registration by about 20 per cent.

The success of these projects has led to proactive contact being incorporated at three points within the Open University's 10-point Learner Support Framework.

Source: Appendix 4, CDEC, 2009

TEACHING "NICHE" SUBJECTS

A number of institutions have developed programmes to support language teaching both for new languages and for those studying English for speakers of other languages (ESOL) courses. Learnosity in Ireland provides one example of this use of mobile technologies.

QUIZZES AND GAMES

Increasingly mobile phones are being used to add a dimension to classroom teaching, especially but not solely in schools. Today's children find it exciting (and perhaps less threatening) to give their answers to teachers anonymously. Teachers can ask children to vote on issues, to set out their ideas and can synthesise and report on outcomes to the whole class.

Principles of gaming technology are also increasingly used to develop material for use in classrooms to keep and maintain children's interest.

LEARNOSITY: USING MOBILE PHONES FOR LANGUAGE LEARNING

Scale: 69 learners aged 14 and 15 in 2007

This Eire-based pilot project uses mobile phones and laptops linked to a Web site to support learning and teaching in Gaeilge. There are several components to the Learnosity system that, taken together, make it unique. These are as follows:

- The use of mobile phones with the interactive voice response (IVR) system.
- Questions are selected at random from a question bank.
- Students can re-record and repeat the process as required.
- Answers are recorded as WAV (compressed audio) files and saved to a server from which they can either be marked online through a Web site or saved and marked as a podcast.
- Students can hear not only their own, but exemplary answers as well.
- Feedback is given in the form of a printout or e-mail which can be saved to an e-portfolio if available.
- New vocabulary can be delivered by SMS text each day for use in class or written work.
- Text-chat with peers through Google Talk. In the pilot this was done with PCs but it could be via PDAs. Teachers can mediate in real time and assess later with the scripts also recorded and saved for self assessment.
- Access to an online dictionary supports further language development.

Outcomes

- 67 per cent students reported that they had made significant progress with oral Irish language in the six weeks of the pilot. There are plans for further trials in six schools, task-based and role-play conference calls and potentially, biometric voice recognition. However, wireless access in schools can be a barrier in remote areas.

See www.learnosity.com/go/client-ncca-ireland

Source: Appendix 3, CDEC, 2009

CONTEXT-SPECIFIC ACTIVITIES

Several institutions report that mobile technologies are helpful in a range of context-specific situations ranging from museum visits, to field work and project work. The availability of functions such as GPS, camera, video, audio and 3G Internet access, which are often now incorporated within one device, make it possible for teachers as well as students of all subjects and across all ages to use these technologies in fieldwork.

WildKey, a spin-out company formed as a result of an Oxford Brookes University research project, now creates a digital toolkit for outdoor learning that enables teachers to make the most of mobile technologies. (For details see Appendix 3, CDEC, 2009.)

MYART SPACE

Scale: 3000 school students with a final study involving twenty-three 11- to 14-year-old learners

MyArtSpace connects a Web-based client that can be accessed on a desktop computer in classrooms or homes with software running on mobile phones in the museums and gallery. Typically, the teacher will set one or more questions or goals to guide the visit. Small groups of learners are given a pre-programmed phone on arrival at the museum and enter a unique identifier.

As they tour the museum, each group can "collect" an object by typing the exhibit code, which accesses an image and brief presentation on the artefact. Learners are prompted to type in their reasons for collecting the object, and they are shown a list of who else has collected it. They are able to add their own audio or text interpretation to support the learning outcomes and goals. The collected content is automatically transmitted over the Global System for Mobile (GSM) phone connection to the MyArtSpace Web site, which builds a personal record of their visit. Back in the classroom or at home the children can log into the MyArtSpace Web site for further discussion and exploration of outcomes and the production of a completed gallery.

See www.myartspace.org.uk/web/index.php

Source: Appendix 3, CDEC, 2009

WORK-BASED AND JUST-IN-TIME LEARNING

There are many examples of the use of mobile technology for work-based learning ranging from just-in-time instructions as to how to stack supermarket shelves (with appropriate explanation and self assessment) to the on-the-job training of hairdressers. Here students have access to the Hairdressing Further Training learning technologies wherever they may be, via their mobile phone, which develops the concept of the mobile phone as a learning device. The content was redeveloped by industry professionals who aimed to bridge the gap between learning in colleges and the experiences of the workplace. As an unobtrusive learning tool, they found the capabilities of mobile technology effectively supported this new style of learning engagement.

(See www.jisccollections.ac.uk/news_and_events/news_articles/hthandheld_winner.aspx.)

LIFETIME HEALTH AND FITNESS: RECORDING EVIDENCE IN DISPARATE WORKPLACES

Scale: 2000 learners in 2007–2008 working towards Apprenticeships, National Vocational Qualifications (NVQs) or Key Skills Qualifications

Learners are scattered throughout the UK and need to be assessed in workplace settings. Lifetime Health and Fitness is seeking both greater efficiency in the assessment process and provision of learning resources in a range of media to suit a range of learning styles.

Assessors are equipped with tablet PCs and digital pens supported by hand-held smartphones, digital cameras and portable scanners and printers for collecting performance evidence in the workplace. Evidence is then uploaded online to an internally developed e-portfolio on a central server.

This has had an impact on performance: improved reporting capability enables tracking and analysis of trainers or assessors activity and regional contracts. This enables timely and targeted management interventions and results in improved retention and success rates of learners. Success rates doubled in 2007 and are now significantly above average for the sector.

See www.thefitmap.co.uk/new/services/training/lifetime.htm

Source: Appendix 3, CDEC, 2009

SUPPORT FOR DISABLED AND INSTITUTIONALISED PEOPLE

A paper from TechDis (n.d.) — a JISC-funded service — on m-learning and accessibility raises some important issues. The report claims that mobiles and hand-held devices are more often perceived to be a positive step towards accessibility. The key reasons are:

- They are personal, and private, removing some of the awkwardness around learning in certain situations (for example, the Foyer study working with people in hostels).
- They are more able to reflect the learner's lifestyle. This covers both young(er) learner familiarity with what are primarily social networking tools in common currency, and the benefits of mobility to busy people on the move or unable to access a suitable learning location.
- They are (relatively) cheap and (relatively) ubiquitous (although care needs to be taken with assumptions here, particularly in sectors dealing with older generations). They can provide access to learning where none was previously available.
- They can work with visual and auditory input and output as well as text.

However:

- Wireless access is not uniform or reliable across even the UK.
- The text size can be hard to read. Older learners and those with sight problems can struggle. Text to voice technology is improving, albeit slowly, and needs to be considered where the learner constituency demands it, (and borne in mind where there is currently no demand)" (Appendix 3, CDEC, 2009).

STRATEGIC ISSUES FOR INSTITUTIONS

It is vital for institutions to think through their strategy for the use of mobile technology. All too frequently small projects are developed by keen individuals within an institution which may be of immense value to small groups of students but which may not be sustainable or transferable across the institution. However, project work can be important and, if controlled, can lead to the increase in knowledge and understanding of the power of mobile technologies within the institution as well as leading to small sustainable activity around a particular subject. There needs to be institutional commitment and/or external funding to engage in large-scale change. Strategic issues facing institutions can be grouped as follows.

PEDAGOGY FIRST

It is very tempting for institutional leaders to adopt new technologies before being absolutely clear as to how such technologies will enhance student support and learning. Distance education is littered with examples of where expensive technological equipment has been purchased in advance of a clear plan for how such equipment will be used and in the absence of staff trained in its use. The use of mobile technology is no different. Advice from the early adopters is that pedagogy should come first. The Learning2Go projects are developing new pedagogies to make the most of mobile technologies.

WHO MAKES DECISIONS?

As Puttnam (2008) has emphasised, it is critical that decision-makers listen to learners and understand that the mobile phone is now the most ubiquitous of communication devices and one which many people, young and old (but especially young) see as part of their day to day life. This provides an especially opportune moment for education and learning to be seen to be a normal part of life. Decision-makers must be aware of the potential of new technologies for mobile learning while at the same time resisting the temptation to buy into a new technology without thinking through the way in which it will be used for teaching and learning and how it can be sustained.

WHO PROVIDES THE HARDWARE AND SOFTWARE?

In many cases institutions expect students to have their own mobile device and it is acknowledged that the functionality of such devices will vary from one student to the next, so institutional decisions need to be taken about minimum specifications. In other situations, hardware is provided by the institution on loan or permanently to the student for use in class and for homework (for example, for quizzes and games). MoLeNET and Learning2Go provide excellent examples of how external funding or resources provide equipment with institutional and parental involvement so that children can keep the devices and feel a sense of ownership and being valued.

Where software is required (for example, for course content, and so on), this is always provided through the institution.

COSTS

This is where real difficulties arise in providing useful data. Two principles emerge:

- Many learners, especially those in higher education institutions are likely to have their own mobile devices and keep them upgraded. Thus there are no hardware costs for the institution apart from the purchase of equipment for staff.
- Where learners do not have the equipment or it is not of high enough specification, institutions need to purchase and loan (or restrict use to the classroom). Some feared that the lending out of equipment would result in damage, loss or would be stolen.

Connection charges also need to be taken into account. The general lesson from this is that any institution wishing to develop its mobile learning activity must research costs well in advance of the start of such activity.

Tribal-CTAD has a clear pricing policy which can be seen by accessing the M-Learning Suite though the Web site www.m-learning.org and clicking on "How to Buy." However, the cost of the full Suite is around £2800, including VAT, for a licence to support 50 tutors and authors and 1000 learners for a year. Clearly this will seem expensive for a limited open schooling provision, but for the major institutions it might be an option worth considering. In addition this does not include the cost of mobile devices which are significant at the higher end of the scale and can cost up to £300.

The speed of development of 3G and 4G phones will inevitably bring costs of these sophisticated devices down and enable more functionality to be available at lower prices; governments must continue to work to bring down the connection costs.

LEARNING2GO: SUMMARY OF FUNDING ARRANGEMENTS

Learning2Go has developed a new method of joint funding in schools which takes place over two years and involves, school, parental and external resources. In summary, their Web site notes that it rests on:

- *Device* — joint funded by parents and school over two years or 100 payments;
- *Content or memory card* — funded via e-learning credits;
- Wireless infrastructure — school funded; and
- *Insurance* — included in device price and joint funded as above.

The UK's eLearning Foundation has been a key partner in this model; see www.e-learningfoundation.com.

Learning2Go Further, the extension of the project to secondary schools and projects, has developed a significant partnership with O2, one of the world's largest telecom providers. This has included a redesigned business model which appreciates the education sector and has moved to a structured affordable model with an emphasis on e-Safety.

See www.learning2go.org

Source: Appendix 4, CDEC, 2009

STAFF DEVELOPMENT

One of the key issues noted by the leading authorities at all site visits and in case studies was how essential it was to have staff development and continuing support for teachers in the use of mobile devices. Leaders at both MoLeNET and Learning2Go said this extended beyond teaching staff and included technical staff; it was also essential to get these staff on side first if using mobile devices in school contexts.

Some of the issues raised were that children are frequently more competent and confident in trying out new technologies and this can feel threatening to teachers who have been more familiar with a didactic model of teaching, where they are the experts. At Learning2Go, however, Dave Whyley, the project leader, noted that the really good teachers welcomed the growing expertise and confidence of their students and drew on this to encourage peer support and collaborative learning. He had undertaken some recent teacher development activities and considered that one of the main difficulties was that teachers lacked models for using mobile devices for learning. Once they had been provided with models, they became less anxious and more enthusiastic about their use. (Further details can be found in the Appendix 4, CDEC, 2009.)

GETTING STARTED: SOME PRACTICAL ADVICE FOR INSTITUTIONS

Keegan et al. (2006) in their seminal work, the *Role of Mobile Learning in European Education*, suggest a four level approach to the introduction of mobile learning within an institution:

- *Level 1* — use of mobile devices in educational administration;

- *Level 2* — use of mobile learning for study help;
- *Level 3* — use of mobile learning for course modules; and
- *Level 4* — use of mobile learning for location sensitive activities (for example, museum visits) and context sensitive education and training (for example, workplace learning).

LEVEL 1: USE OF MOBILE DEVICES IN EDUCATIONAL ADMINISTRATION

The first level of mobile learning recommended is the use of mobile devices in educational administration. Illustrations of this usage are given from school and college administration, in the combating of dropout and use in distance education. If a lecture, tutorial or examination has to be cancelled at short notice, and the institution communicates with the student body concerned by SMS (short messaging system), all of the students will receive and read the message, no one will turn up, no one will be inconvenienced. SMS messages can be sent in this way either to the whole student body, a faculty, a department or a class grouping.

Other examples of use of mobile telephony in educational administration are the following messages:

- from headmaster to parents: “Your son or daughter will be late home from school today as he or she has received a detention”;
- from parent to school: “My child is ill and will not be in today”;
- changing the date, time or location of examinations;
- changing deadlines for enrolment; and
- changing the deadline for presentation of an assignment.

LEVEL 2: MOBILE LEARNING FOR STUDY HELP

Messages can be sent from the institution to the student focusing on course summaries, to help with a difficult assignment, to assist with a part of a course that has given difficulties to students in the past, to notify the student of enrolment or assignment deadlines, to offer tutorial advice or to ask multiple-choice questions in the following formats:

- communication and interaction with peer learners and study groups;

- browsing e-learning course material;
- downloading study guides or manuals;
- receiving tutorial letters;
- completing multiple choice assessment with immediate feedback;
- providing generic feedback on assignments and examinations;
- sending motivational messages;
- downloading of material (sections of learning materials, assignments, letters, and so on);
- accessing examinations and tests; and
- accessing financial statements and registration data via a mobile service number.

LEVEL 3: USE OF MOBILE LEARNING FOR COURSE MODULES

The next step is the provision of full course modules on mobile devices or via podcasting.

LEVEL 4: COMPLETE INCORPORATION

Keegan et al. (2006) suggest the goal is that mobile learning should enter into mainstream education and training and no longer rank as a project in the institution. For acceptance into the mainstream four criteria are required: (1) accreditation, (2) curriculum, (3) assessment and (4) fee-paying; for example, they believe that the enrolment of mobile learning students into accredited courses is a goal of mobile learning. If a course is not presented as accredited in the prospectus of the institution, it remains at the level of a research project and has the fragility of project status.

In our survey we have found no examples of Level 4 activity and indeed we suspect that this is step too far for mobile learning at this stage. There may be some downsides to mobile learning if it is taken as the sole method of learning.

EVALUATION, STUDENT FEEDBACK AND QUALITY ASSURANCE

Clearly, effective evaluation is vital if small projects are to enter the mainstream and to become sustainable. Almost all the myriad of small projects over the past five years have involved evaluation and almost all of it has been based on learner feedback. While this is of central importance there appears to be little feedback from teachers (other than those who designed and

developed projects) and little external assessment of individual projects. Educational research is complex and it is extremely difficult to isolate factors which lead to improvements in learning and retention rates in the short term. In our researches we found only a few examples of experiments involving control groups and few surveys which were based on samples large enough to make conclusions reasonably valid. However, there are some research projects which provide some useful information; these include the European M-Learning project (Attewell, 2005) and the case study of MoLeNET.

STUDENT FEEDBACK FROM THE EUROPEAN M-LEARNING PROJECT 2005 (ATTEWELL, 2005)

Here some 128 learners from the UK, Italy and Sweden took part in a research programme and the outcomes of this are summarised as follows:

DEMOGRAPHICS OF THE LEARNERS

- 55 per cent under the age of 19;
- 51 per cent female;
- 49 per cent in Further Education institutions;
- 89 per cent were judged to have literacy or numeracy needs;
- 78 learners had either dropped out (59) or were at risk (19);
- 80 per cent were unemployed;
- 39 were homeless; and
- 9 were nomadic travellers.

These demographics indicate that there are students who have had significant difficulty in learning in conventional educational settings.

BASIC RESULTS

- Students were mostly enthusiastic with preferences for future learning highest for PCs and laptops, second for mobile devices and last, face-to-face at college.

- 82 per cent respondents reported help with reading and spelling but mentors suggested only 29 per cent had developed a more positive attitude to reading.
- 78 per cent of respondents thought mobile devices could help their maths.

The above is fairly typical of research results in general; notably that mobile devices can attract young people to learning, maintain their interest and provide some help.

SOME OBSERVATIONS

Mobile learning helps:

- in identifying where learners need support;
- to combat resistance to ICTs;
- to remove some formality from the learning experience and engage reluctant learners;
- to help students remain focused for longer periods; and
- to raise their self-esteem and self-confidence.

MOBILE LEARNING NETWORK

MoLeNET describes itself as follows:

"a unique collaborative approach to encouraging, supporting, expanding and promoting mobile learning, primarily in the English Further Education sector, via supported shared cost mobile learning projects. Collaboration at national level involves participating institutions and the Learning and Skills Council (LSC) sharing the cost of projects introducing or expanding mobile learning and the Learning and Skills Network (LSN) providing a support and evaluation programme. The LSC and institutions are investing over £12 million in MoLeNET. The MoLeNET support and evaluation programme includes technical and pedagogic advice and support, materials development, continuing professional development, mentoring, facilitation of peer-to-peer support, networking and resource sharing, evaluation and research."

See www.molenet.org.uk

QUALITY ASSURANCE

Although the UK Quality Assurance Agency does not provide specific guidelines for mobile teaching and learning it does set out comprehensive guidelines for distance education in higher and further education. Fundamentally, the principles on which quality assurance processes for distance education are based, apply equally to mobile learning.

CONCLUSIONS AND RECOMMENDATIONS

There is no doubt that the use of mobile technology in education is here to stay. Costs will come down and functionality will increase. From 2010 all new phones will have connectivity of some kind (e-mail or Internet). The balance between portability and larger keyboards and screens is one which will be crucial in the next two years.

Developments in mobile learning will be driven by the younger generation of "digital natives," but they will need support. However it is not at all safe to assume that because someone is young they will be able to obtain the maximum benefit from mobile learning without support.

Mobile technology will continue to be used in a variety of environments; for example, within the classroom, anywhere, anytime and particularly at home, on field trips for a variety of purposes; for example, for administration, learner support, whole course and perhaps, in due course for fully accredited, stand-alone courses.

There is considerable evidence that mobile technology encourages reluctant learners to take up learning activities but mentoring support is a crucial element for success.

In higher education mobile technologies are used as additional tools, which provide easy access to Web-based learning management systems which are already accessed through PCs. Where there is no access to the Internet or where learners cannot afford PCs, mobile phones (owned or rented) can be invaluable for administrative information, leaner support and short bursts of learning especially through games and quick quizzes if the phones functionality supports these activities. Specific recommendations drawn from the report include:

1. CLARIFICATION OF OUTCOMES

It is important to be clear about the desired outcomes for the use of mobile devices; this will have a major impact on the type of device, costs and support systems. To use Tait's (2000) distinctions, if learner support is intended to be mainly:

- *Administrative* — It may be possible to use cheaper phones and SMS messages.
- *Cognitive* — More sophisticated devices and software may be necessary.
- *Affective* — A range of devices could be used but the level of messaging and options needed would need careful research in context.

2. CLARIFICATION OF LEARNER CONTEXTS AND LEARNING PURPOSES

As an extension of the above, it will be important to be clear about learner contexts in terms of the range of devices and software needed (for example, whether the device is being used):

- to enhance existing teaching and learning;
- to support students who have no other access to learning;
- to support reluctant learners; and
- to undertake fieldwork.

3. RESEARCH INTO COSTS

This includes research into the possibility of partnerships with large commercial providers such as O2, Telefónica O2 UK Limited, a leading communications company.

4. PUTTING PEDAGOGY FIRST

Research so far indicates that simply transferring computer content on to a small screen does not support learners in the most effective ways. New pedagogies and materials are being developed and the lessons learned from this process should be maximised.

5. INSTITUTIONAL OR HIGH LEVEL COMMITMENT

The introduction of mobile devices has not been straightforward in any of our examples and their advice is that it will not succeed without high level of commitment.

6. SUPPORTING THE STAFF WHO ARE ENGAGING WITH PUPILS, STUDENTS OR PARENTS

Many of the main difficulties in effective implementation of some of the projects examined here have been the lack of engagement of staff and hence their reluctance to use devices or to explore their potential. Support and staff development is essential to overcome the first hurdles in this area. Where schools are concerned it is vital to engage parents by providing information and explanations of the use of mobile technology in the school.

7. SUPPORTING THE STUDENTS

Projects reported that the use of mobile devices is not always intuitive, even for the so-called digital natives (in the UK the average age for first ownership of a mobile phone is eight (*Telegraph*, 18

February 2009). Some students therefore may need support in the use of the devices, and this may involve some technical support.

Wherever possible, it is clear from projects cited that personal ownership of the device by a student is to be recommended, and that the funding arrangements which involve parents, schools and external agencies in the purchase of equipment can make this provision possible in some contexts.

Finally, Dave Whyley of Learning2Go, recommends “trusting the children”: they rarely break or lose the devices; they learn responsible use of mobiles and the Internet; they develop skills in peer support.

8. EVALUATION AND QA

It is essential to build in evaluation from the start and this will involve tracking student performance and behaviour across several years with control groups where possible. Other forms of evaluation and QA also need to be embedded from the outset.

NOTE

This chapter is an edited version of a project report entitled "Using Mobile Technology for Learner Support in Open Schooling" prepared for the Commonwealth of Learning by Anne Gaskell and Roger Mills of the Cambridge Distance Education Consultancy (CDEC). The full report is available at http://www.col.org/SiteCollectionDocuments/Mobile_Technologies_FinalReport.pdf (accessed 18 June 2009).

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CHAPTER 4: LESSONS LEARNED AND GUIDELINES

LESSONS LEARNED

We present here a summary of lessons learned through the review of literature and two desktop research projects conducted in Europe and Africa. The lessons learned are as follows:

- Access to mobile technologies is not a barrier as it has becomes more and more ubiquitous.
- Mobile technologies bring in unique educational affordances: portability, interactivity, context sensitivity, connectivity and individuality.
- Use of mobile technology in schools increases student motivation and improves collaboration and communication among learners.
- Mobile technologies promote knowledge creation and learner involvement.
- Appropriate mobile technology use improves test scores and has positive impact on management of study time by the learners.
- Capital cost of mobile technology is negligible, and the running cost is nominal.
- Mobile technology should be used to provide content support such as hints, tips, summaries, and so on.
- It is most useful for *administrative* support purposes, though *cognitive* and *affective* level support can also be provided.
- Mobile technology can provide multi-channel learning and individualise learning experiences though provision of multimedia courseware (podcasting, video, file sharing, and so on).
- Institutional commitment to support mobile learners is highly important, as the response time from teachers and support staff needs to be reduced.

- Using already available digital resources by re-purposing for mobile delivery reduces cost and operation.
- Intelligent software makes learning material portable across multiple mobile devices, and content should be made browser enabled.
- Mobile instruments should be owned by the learners and no specific system should be recommended.
- Mobile learning should be designed on the basis of the principles of learning and affordances provided by the technology.
- Video delivery for mobile technologies should be considered for screen sizes above 2.28 inch.
- Mobile devices are compatible to the special needs of learners with disabilities, and their use makes educational programmes more accessible.
- Though m-learning can be used in all disciplines, it is more useful to some disciplines such as language learning, literacy development, numeracy, communications, medicine, engineering and scientific disciplines.
- M-learning should not be considered as an independent option for delivering a course; rather it should be considered one of the mainstream options to access the learning materials and support services of a course or programme.

GUIDELINES

A set of guidelines are proposed here on the basis of the lessons learned. While Bate's (2005) ACTIONS (Access-Cost-Teaching function-Interactivity-Organisational issues-Novelty-Speed) framework is quite useful in the choice of technology, its application for mobile learning technologies may result in a positive decision in favour of it in most educational institutions, including open schools in developing countries. Mobile technologies:

- are *accessible* to learners (it is increasing at a faster rate);
- are cheap and affordable (less *costly* for both institutions and learners);
- are useful for numerous *teaching* functions (and are useful in learner support);
- are *interactive* and therefore improve two-way communication at a distance and reduce the transactional distance between the learner and the teacher and the educational institution because mobile technologies are easy to use and user friendly;

are so pervasive and simple that they require less *organisational* preparedness;

- have *novelty* value, as they are the latest technology trend (and can motivate both teachers and learners to use); and
- provide the highest *speed* (quickness) in terms of access to latest information and knowledge from anywhere, anytime.

However, as the field of mobile technologies grows, despite the huge amount of literature available, educational institutions take an unknown journey in the field of m-learning due to a lack of models to emulate. As in all technological innovations, the initial cost is high for mobile learning, and appropriate funding should be worked out in the beginning for the system to be successful. Though every institution will have their specific requirements, we offer here some general guidelines for using mobile technologies in open schools. To help educators take context-specific decisions to implement the use of appropriate mobile technology, I propose a set of guidelines based on the mnemonic "PICTURE this"; in other words, educators deciding to use mobile technology should PICTURE:

- *P* – plan purposefully
- *I* – identify learners' needs
- *C* – choose media
- *T* – technology implementation
- *U* – user manuals
- *R* – run the system
- *E* – evaluate performance and outcomes

Each aspect of these guidelines can be explained further, as follows.

PURPOSEFUL PLANNING

Once the use of mobile technology in an educational setting is finalised, the first step should be to carefully plan its implementation in a systematic manner. It has been said that "The inability to plan is planning for failure."

As mobile technologies can be used for different purposes in an educational setting, it is important that specific institutional purposes are clearly articulated. Some typical purposes of use of mobile technologies could be:

- to provide access to learning materials and resources anytime, anywhere;
- to improve teacher-learner and learner-learner interaction;
- to interact with the learning materials and resources such as self-tests;
- to provide administrative information about schedules, calendar, programme information, grades and results;
- to provide motivational messages and guidance; and
- to provide opportunities to undertake fieldwork and context-sensitive projects in specific courses.

IDENTIFICATION OF LEARNERS' NEEDS

Without considering the needs of the learners in a systematic manner, the design, development and delivery of any m-learning system would be not only difficult but also irrelevant. Substantial research should be undertaken to understand types of information needed by the learners, how they will access these information on a mobile, which mobile devices are in predominant use and the cost to learners. Categorisation of these needs into groups would facilitate the design of the frequently asked questions database and the m-learning technology. The learners' needs from m-learning system could be categorised into *static* and *dynamic* and *interactive* and *non-interactive.* We provide a matrix of such information in Table 2.

Table 2. Categories of learners' needs for m-learning

	Static information	Dynamic information
Non-interactive (broadcast type)	Last date of submission of assignments	Tips, news, etc.
	Last date of filling examination forms	Podcast lectures
	Cancellation of a counselling session	Video
Interactive (student query type)	Eligibility in a programme of study	Teleconference
	Grade in assignment and term end examination	Chatting, discussion
		Games

CHOICE OF MEDIA

The information services and teaching and learning through the use of mobile devices require different media based on the purpose and the learners need. The use of media could be text-based (through SMS and Web interface), audio (through podcasting), video (as MMS or download) and animation and games (through download). A systematic media analysis for different tasks to be performed using mobile devices would identify the system requirements at the learner end as well as for the teacher (institution).

TECHNOLOGY IMPLEMENTATION

At the implementation stage, educators should have clarity on what they want to achieve with the use of mobile learning technology. A detailed project report would enable internal system engineers and/or external technology consultants to design a system and deliver the same on a planned timeframe. At this stage, decisions have to be taken to use exiting digital resources (adopt, adapt) or create them for mobile learning. Content development takes time, and

therefore, technologies such as the Moodle Mobile (MOMO) can be used to deliver existing online course on mobile. This phase takes time and may undergo several iterations before it is made available to the learners. Thus, user testing of the system is a must before it is put in place.

USER MANUALS

In order to effectively use the m-learning system, three types of user manuals should be made available for (1) systems engineers and administrators; (2) for teachers and support staff; and (3) for learners and public users. A systematic user manual made available in print to all stakeholders makes the transition to the use of new technology smooth. The user manual should include basic rules (Do's and Don'ts) for using the system. It is also useful to specify technological requirements and technology help lines available for support. Help to users is part of the institutional commitment and should be made clearly known to all the stakeholders.

RUN THE SYSTEM

Once the technology and content is in place, it is fairly easy to run the system. Running of the system requires round-the-clock support and commitment on the part of teachers and support staff. This can be easily ascertained, provided the implementation of the technology is a collective decision, design and development effort; by considering the opinions of all stakeholders, it becomes easier to run the system as a techno-cooperative. Updating of the relevant databases in the system regularly would be paramount to the success of the m-learning system.

EVALUATION OF THE PERFORMANCE AND OUTCOMES

An evaluative framework should be built into the m-learning implementation strategy. Thus, feedback from the stakeholders should be gathered from time to time to assess the usefulness of the system and to plug deficiencies. A quick decision-making process needs to be in place to respond to feedback. The objective of evaluation should be to assess the impact of the technology, as well as its use in developing new teaching-learning models across disciplines.

And at the end, I emphasise: “Training has in-built success!”

For new mobile technology to be assimilated into the mainstream of an institution, it is necessary to establish a well-thought-out adaptation model and staff development plan. As long as users are dependent on programmers and engineers, they are not in a position to embrace technology and use it regularly. The development plan should empower end-users to think about the

appropriate use of mobile technology in their teaching and learning support. Systematic training is important. Appropriate, regular and continuous training of the institutional stakeholders would facilitate buy-in and use of mobile learning.

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