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MOBILE LEARNING FOR TEACHERS IN AFRICA and the MIDDLE EAST

> Exploring the Potential of Mobile Technologies to Support Teachers and Improve Practice

TEACHER FOCUS

UNESCO Working Paper Series on Mobile Learning

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ABOUT THE SERIES

This paper is part of the UNESCO Working Paper Series on Mobile Learning. The Series seeks to better understand how mobile technologies can be used to improve educational access, equity and quality around the world. It comprises fourteen individual papers that will be published throughout 2012.

The Series is divided into two broad subsets: six papers examine mobile learning initiatives and their policy implications, and six papers examine how mobile technologies can support teachers and improve their practice.

Within the two subsets there are five geographical divisions: Africa and the Middle East, Asia, Europe, Latin America, and North America. Each subset also contains a 'Global Themes ' paper that synthesizes central findings from the five regional papers.

Two additional 'Issues ' papers round out the Series. One paper highlights characteristics shared by successful mobile learning initiatives and identifies supportive policies. A separate paper discusses how mobile technologies are likely to impact education in the future.

As a whole, the Series provides a current snapshot of mobile learning efforts around the world. Collectively and individually, the papers consolidate lessons learned in different regions to provide policy-makers, educators and other stakeholders with a valuable tool for leveraging mobile technology to enhance learning, both now and in the future.

UNESCO has plans to add additional titles to the Series after 2012. The Organization hopes that these resources will help diverse audiences better understand the educational potential of mobile technologies.

To access existing and forthcoming titles in the Series, please see:
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ABSTRACT

The Africa and Middle East (AME) region suffers an endemic crisis in its teaching and teacher development systems. This crisis manifests as a shortage in the number of qualified teachers and a dearth of motivated teachers who can deliver quality teaching and learning within a twenty-first-century educational context. It is widely believed that addressing this challenge requires a range of interventions, including the integration and use of information and communications technology (ICT) and open and distance learning (ODL) opportunities (Perraton, 2007). More recently, the rapid growth of mobile phone subscriptions in the region has sparked interest in how mobile phones in particular might enhance ODL opportunities for the professional development of teachers, and support teachers in their pedagogical practices and administrative duties. The purpose of this paper is to provide an illustrative overview of emerging mobile learning programmes that seek to improve or expand access to teacher development and support the changing roles of teachers in the AME region.

In AME, nearly all teachers, including those who are privileged with access to a personal computer (PC) or laptop, will invariably have access to a mobile phone, a situation which holds great potential for using mobile phones in teacher development. However, research-based evidence that mobile phones can enhance and support teachers' professional development and ODL in the region is very sparse. The projects that do exist have been mostly experimental and conducted in isolation from existing teacher development programmes. Furthermore, not only are there very few mobile learning initiatives focused on teacher development and ODL, but the information on the results of these initiatives and how they have impacted teaching and learning is even more limited.

This review highlights a range of projects that show, for example, how Short Message Service (SMS) technology facilitates communication with student-teachers in remote areas; how mobile phones can serve as a curriculum-delivery platform; how education management and information systems can be supported by mobile phones; and how mobile phones have enabled peer support, teacher training and continuing teacher professional development (CTPD). The review reflects not only a variety of uses for mobile phones but also a wide range of technology solutions, from low-end communication services in remote areas to more complex and integrated high-end learning management solutions.

Poor-performing education systems, poor-quality teaching and a lack of educational resources to support learners and teachers in the region all feature as key drivers for the emergence of mobile learning, due to its potential to open up new avenues for improving the quality of teaching, learning and education management. Mobile learning development is further enabled by the rapid and widespread growth of mobile phone access in the AME region, to the extent that most teachers now own or share the use of a mobile phone. However, access to mobile telephony is not yet universal, with some countries, especially in sub-Saharan Africa, still facing low penetration levels. This situation features prominently among the barriers to mobile learning in AME. Other inhibiting factors include the lack of mobile learning integration in teacher-training institutions (TTIs) and the lack of leadership on mobile learning by government Ministries of Education (MOEs).

This review acknowledges the dearth of evidence-based research and the limited credibility and trustworthiness of available information on mobile learning in the AME region. It recommends case-building and evidence-development on mobile learning in support of teachers, teaching and teacher development. The review further suggests that TTIs be encouraged to take a leadership role by launching mobile learning programmes that involve their lecturers, student-teachers and administrators, and by building partnerships with local network operators and content providers.

The review concludes that the availability of mobile learning opportunities in the context of the emergence of a generalized mobile society holds significant potential for resolving the region's educational challenges. However, for this to happen, mobile learning will need to be supported by political will and leadership in order have a genuine impact on a region whose education systems are plagued by crisis.

BACKGROUND AND METHODOLOGY

Across Africa and the Middle East, from the bustling metropolis of Riyadh in Saudi Arabia to rural Beira in Mozambique, mobile phones form part of the lives of teachers as consumers, educators, administrators and adult learners. This review explores how teachers in these various roles have appropriated and used mobile phones and what the educational benefits have been, if any.

The focus of the review is on an illustrative list of teacher-related mobile learning projects, which are considered against the backdrop of the diverse socio-economic and cultural contexts that shape the teaching experience in the region.

A qualitative research methodology was used to explore the use of mobile phones in the real-world context of teachers in the region. The primary questions that guided this review are:

1. What initiatives have emerged in the region that support teachers, teaching and teacher development?

2. How have teachers appropriated the use of mobile phones in support of their functions as educators?

3. What lessons can be drawn from the experiences to date that can inform the effective design of teacher development programmes in the region?

Because of time and budget constraints, the scope of the research has been limited to reviewing documents which were obtained through internet searches and from researchers investigating mobile learning in the region. Informal discussions were also conducted with three project managers in the mobile learning field, via Skype and through face-to-face interviews. Additional information was provided by Gerald Henzinger, who as a volunteer initiated a mobile learning project for teachers in Mozambique; John Traxler, Professor of Mobile Learning at the University of Wolverhampton; Steven Vosloo, Mobile Learning Specialist at UNESCO; Phumzile Mlambo-Ngcuka ,who is currently reading for a Ph.D. in mobile learning at the University of Warwick; and Riitta Vänskä, Senior Manager of Mobile and Learning Solutions at Nokia's Sustainability Operations. The review also draws on the insights from the First UNESCO Mobile Learning Week, a meeting of mobile learning experts hosted in Paris in December 2011.

This review did not find many initiatives in the region that are specifically related to the use of mobile phones by educators to support their teaching and professional development. The information available on many of the identified initiatives were mainly of a descriptive, anecdotal or promotional nature. There were also very few independent monitoring and evaluation reports related to mobile learning projects for teachers. In some cases however, academic research papers were available. These mainly explore the idea of mobile learning for teacher support at a theoretical level. These limitations reflect the dearth of substantive evidence to demonstrate the efficacy of integrating mobile phones into teaching, teacher support and teacher development. The fact that this review was only able to uncover a few

initiatives may indicate a bias against projects that were not known when the review was undertaken. More examples of mobile learning for teachers may exist but were not widely publicized or well-known at the time of writing. Because of this, drawing final conclusions based on the limited information in this review would be premature. However, the illustrative examples highlighted in this paper offer some insights into mobile learning for teachers that may be useful for future exploration and consideration.

It is difficult to generalize when situated in an extensive geographical region with vast differences in its cultural, linguistic, political and economic contexts across and within national boundaries. Nevertheless, based on information available on teachers in the AME region, the following description is likely to be accurate: the average public school teacher in Africa and the Middle East is most probably male and under 35 years old, is underqualified, teaches in an overcrowded classroom where there are likely to be more learners than desks and textbooks, and teaches students who are malnourished and possibly orphaned by HIV/AIDS and who come from impoverished homes. He is most likely underpaid, has a high-pressure workload focused on delivering an exam-centred curriculum, holds more than one job to compensate for low pay, and is generally technophobic but possesses a low-end mobile phone that he uses mainly for phone calls and text messaging (extrapolated from UIS, 2009).

This profile reflects the nature of the endemic crisis in teaching and teacher development in the region, which is based on a dearth of qualified and motivated teachers who can deliver high-quality teaching in a twenty-first-century context. Despite the growth in teacher numbers over the past few decades, there remains a deficit in the number of teachers needed in the region's education systems. The UNESCO Institute of Statistics (UIS) reported that between 1970 and 2008 in Africa, the number of primary-school teachers increased from 620,000 to 2.8 million, and the number of secondary-school teachers rose from 180,000 to 1.8 million. Despite this increase over approximately four decades, UIS reported that by 2008 another 1 million teachers were still needed in the system (UIS, 2009). This shortage is confirmed by UNESCO's *EFA Global Monitoring Report 2011*, which estimated that more than 50% of the 1.9 million teachers needed globally to reach the Education for All (EFA) goals by 2015 are needed in Africa alone. If teacher attrition is considered, sub-Saharan Africa will need to recruit an estimated 350,000 new primary-school teachers per year until 2015. UNESCO concluded that reaching EFA by 2015 is highly unlikely in AME (UNESCO, 2010; 2011). The absence of a sustainable supply of qualified teachers in the region's education systems is based on a number of interrelated factors, as illustrated in Figure 1.

Figure 1. Factors influencing teacher supply and quality in AME

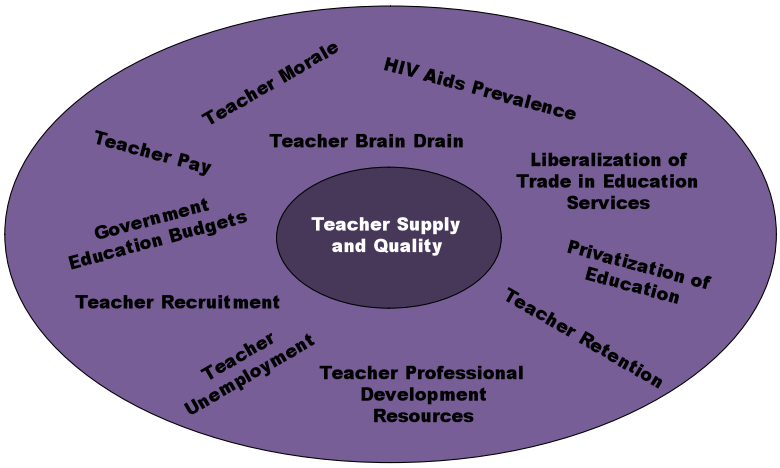


Figure 1 provides a partial picture of the complex interrelated socio-economic, political and cultural factors that influence the supply of qualified teachers in the region's education systems. Education systems are also challenged by the demands of the twenty-first century and the endeavour to create an inclusive 'knowledge society' (UNESCO, 2005). These demands are imposing further changes to teachers' responsibilities, required skills and professional roles. Notably, teachers' roles are transitioning from the 'sage on the stage' model, which focuses on the transfer of knowledge to learners, to the 'guide on the side' model, with a focus on the teacher as a facilitator of learning. Under these conditions, effective strategies for teacher recruitment, retention and professional development need to be combined with strategies that engage with new and emerging pedagogies catalysed by ICT, including mobile phones.

Historically, it has been widely accepted that the use of ICT and ODL in teacher education, when applied appropriately and accompanied by a host of supportive education system reforms, can catalyse an improvement in the supply and quality of qualified and capable teachers in the region. Perraton (2007) suggests that ODL is increasingly being used to:

- Provide cost-effective pre-service and in-service teacher education
- Support school-based pre-service and continuing professional development programmes for teachers
- Certify unqualified teachers and enable qualified teachers to acquire higher teaching qualifications
- Provide teachers in remote or rural areas with access to professional training, thereby meeting their continuing professional development needs
- Ensure the quick dissemination of information to large numbers of teachers about curricular innovations, new teaching methodologies and practices, and new professional standards for teaching

In the AME region, a number of programmes have been established to support ODL for both pre-service and in-service teachers. Many of these programmes have been accompanied by ICT-access initiatives. These include the roll-out of PC labs for teacher use in many schools across AME; the provision of laptops for teachers, such as in South Africa (DOE, 2009) and Kenya (Mbuvi and Ochieng, 2010); and the emergence of open educational resources (OER) for production and consumption by teachers, such as the open courseware made available by the African Virtual University (AVU) based in Kenya. However, while there are a number of ICT-enhanced ODL initiatives underway in the region, access to ICT and ODL opportunities for teachers remains limited (Touré, 2008). The emergence of near-universal access to mobile phones relative to desktop and laptop computers is far more significant in its potential to increase access to educational opportunities and ICT for teachers in the region.

The vast majority of teachers in AME, including those who are privileged with other forms of ICT access, will invariably have access to a mobile phone. In Africa alone, growth rates for mobile phones are the highest in the world; by 2011 there were 620 million mobile subscriptions on the continent, out of a population of just over 1 billion (GSMA and A.T. Kearney, 2011). In the Middle East (excluding the North African countries), mobile

penetration rates were expected to reach 93.9% in 2011 and 125.5% in 2015 (Cherrayil, 2010). Prepaid offerings, the continued liberalization of the telecommunications sector, and the expected uptake of third generation (3G) services are all major contributors to mobile growth. At its 2010 African Union forum in Ethiopia, the International Telecommunication Union (ITU) declared the mobile phone the 'mass ICT technology of choice for Africa' (Fripp, 2010). Mobile phones are considered 'revolutionary' due to their wide range of economic and social uses by African consumers. Mobile networks and low-cost computing devices are poised to offer the benefits of full internet access to people in the region who could not previously afford it (Otto, 2011).

This trend has opened up prospects for exploring how mobile communications can support improvements in educational access, quality and management in the AME region, particularly in the sphere of teacher education and professional development. Perraton (2010) suggests that the prospects of integrating mobile technologies, particularly mobile phones, into ODL opportunities for teachers are worth exploring because they open up possibilities for reaching larger numbers of teachers in remote and resource-poor areas.

RESPONSES TO TECHNOLOGY BY AME TEACHERS

In the AME region, teachers' responses to the integration of technology into teaching and teacher development range from technophobia at one extreme to enthusiasm and innovation at the other. An evaluation of the use of personal laptops and the integration of XO laptops developed by the One Laptop per Child (OLPC) programme among learners in a semi-rural primary school in Rwanda found that initially teachers felt intimidated by technology, due to their lack of exposure and the fact that the language options for the operating systems and applications did not include their native language (Ernst and Young, 2010). This finding is consistent with those reported by Agbatogun (2010) and Fanni et al. (2010), who showed that the adoption and use of ICT by teachers in classroom practice and for their own professional development, in different African settings, was influenced by teachers' attitudes toward ICT. For instance, in a survey of teachers in the Nigerian State of Ogun, Agbatogun found that the use of ICT by teachers was affected by their self-concept and level of anxiety about computers.

On the other hand, the AME region also has a number of teachers who make innovative use of technology to support teaching and learning. Each year a number of teachers from the region are recognized and awarded for the innovative ways in which they have used technologies to support high-quality learning experiences. The annual Partners In Learning Innovative Teacher Awards in Africa and the Middle East, hosted by SchoolNet South Africa and Microsoft, are an example of this recognition. During 2011, after winning their respective country-level Innovative Teacher Awards, 200 teachers from across the AME region competed for the regional prize by describing the new and creative ways in which they have harnessed ICT in support of effective teaching and learning. A female teacher, Noura Aldowaikh from the Secondary School in the industrial city of Jubail, Saudi Arabia, won the regional award for her project entitled 'Ms PC' which highlights the importance of technology in education (Ghafour, 2011). The majority of innovations have been based on PCs and social media, and very few relate to mobile phones in particular. One notable exception was the project

developed by Kumaras Pillay from Burnwood Secondary School in South Africa's Kwazulu Natal province, who won an award in 2007 for developing innovative mobile phone applications in mathematics and science and making them widely available among learners and teachers (SchoolNet SA, 2011).

Due to their widespread proliferation among teachers for personal use, mobile phones hold greater potential than PCs or laptops for educational use by significantly larger numbers of teachers in AME, including those in remote, socio-economically deprived areas. However, as Mafenya (2011) points out, most users do not consider the mobile phone's potential for education. The reality is that many teachers are not aware of the educational potential of mobile phones, especially when the evidence to support mobile learning is sparse.

MOBILE PHONES AND TEACHER SUPPORT

A number of small-scale pilot projects in AME have attempted to explore the potential of mobile phones to support teachers, teaching and teacher development. Illustrative initiatives are discussed below in terms of their potential to (a) overcome teachers' technophobia; (b) extend teacher training and development to remote areas; (c) support teachers in their classroom practice; (d) improve educational management and administration; (e) enable peer support for teachers; (f) support teacher training; (g) enhance professional development; and (h) strengthen teachers' competencies in relation to ICT.

OVERCOMING TECHNOPHOBIA

In South Africa, Life Orientation and Life Skills (LOLS) is a recognized subject in the South African school curriculum from Grade R ('reception year') to Grade 12. The subject is focused on the personal, social, intellectual and emotional development of learners, and includes topics ranging from preventing and coping with drug abuse, HIV/AIDS, and child abuse; to study skills and career guidance. Modelled on the Dr Math on MXit project, a mobile learning project to support students' math skills, a Dr LOLS project was introduced that involves a team of dedicated tutors who support learners and teachers with guidance on life skills topics via MXit – a popular, low-cost instant messaging service that runs on web-enabled mobile phones and PCs. Learners log onto MXit, and the team of tutors log onto a Dr LOLS website from a computer where they interact with the learners via the internet. The project involved 500 learners in 2010, some of whom reportedly also helped teachers with the subject. Teachers indicated in interviews that they learned more about the LOLS curriculum through this programme, improved their texting skills, and overcame their fears of technology.

The Dr LOLS project provides an example of how mobile phones can enable learners to also act as 'teachers' by helping their own teachers use mobile devices in support of curriculum delivery. The project also demonstrated that personalized engagement with the curriculum through mobile phones can help teachers overcome their anxieties about using technology in their classrooms (P. Mlambo-Ngcuka, personal communication, December 2011).

EXTENDING EDUCATION TO REMOTE AREAS

A pilot project at the Centro de Ensino à Distância (Distance Learning Centre, CED) of the Universidade Católica de Moçambique (Catholic University of Mozambique) in Beira explored the use of bulk SMS and interactive SMS services to support teachers who live in very remote areas where there is restricted or no access to electricity or the internet. Due to the high demand for teachers in Mozambique, the government regularly certifies teachers without qualifications; as a result, a large number of teachers in the system are underqualified and undertrained, and many feel pressure to obtain a formal teaching degree to keep their jobs. The CED distance learning programme at the Catholic University offers the possibility for these teachers to earn a legal degree for teaching even when they are living in remote areas. The programme is in such high demand that the number of students reportedly doubles every year. This rapid growth adds pressure to the institutional capacity of the CED to deliver their programmes efficiently and effectively. In 2011, a significant number of students did not receive any learning modules at the first contact session at all, while other students reportedly complained of poor-quality photocopies. These complaints are indicative of the kinds of challenges that the institution faces.

In 2009 the CED introduced an interactive SMS system, through which learners could receive notifications via bulk SMS as well as send SMS messages to the institution. The technology was stable but the internal structure of the CED did not have the capacity to respond to the high number of student questions, and the ICT staff were not able to maintain the system. Only the bulk SMS system remained in regular use, while the interactive SMS system was used by the credit-control department only. The bulk SMS system served mainly as a means of communicating with learners. In this sense, it is less of a 'mobile learning' project and more of a communication service between staff and students at the CED. While the project experienced a number of problems with network coverage, which was erratic especially because the mobile phones in use were largely clones, it demonstrated the possibilities for improved communication with teachers based in remote areas who are engaged in distance learning. However, as with many pilot projects, in this particular case the project was initiated by a single individual – a volunteer from Europe – and was not sustained after the individual left (Henzinger, 2011).

The CED project confirmed the view expressed by Perraton (2007) that mobile phones have the potential to improve communication and deliver ODL to teachers and student-teachers based in remote rural areas. The project showed that even if mobile phones are not delivering curriculum, they provide an easier, more flexible and much quicker way to communicate and share information than traditional alternatives, thereby holding the potential to support and improve information management and administration systems. For this approach to be effective in a place like Beira, however, the technical infrastructure and institutional capacity constraints will have to be addressed. The CED project demonstrated that the sustainability of mobile phone-based initiatives by local institutions remains a challenge in the region's remote areas.

SUPPORTING TEACHING PRACTICE IN CLASSROOMS

This review found several examples of mobile learning projects that illustrate the potential of mobile phones to support classroom teaching and curriculum delivery. These projects, which were implemented in South Africa, Tanzania and Mali, are described in the following sections.

CURRICULUM DELIVERY IN SOUTH AFRICA

In South Africa, a training and skills development company called Radical Learning has developed a product that provides teachers with daily lesson plans in mathematics and literacy from Grade R to Grade 3, as well as a weekly homework activity schedule for parents to stay up-to-date on their children's schoolwork. The lesson plans and homework schedule are accessible via internet-enabled mobile phones (Graham, 2012). The mobile phone serves as a curriculum-delivery platform where learners, teachers and parents can work with lesson plans that are available on the mobile phone itself. These lesson plans include interactive curriculum-based lessons that enable students to learn content related to specific school subjects. In this way, the mobile phone supports the teacher's function to deliver a prescribed curriculum and facilitates lesson planning outside of class. By enabling parents to also have access to lesson plans, the project encourages more parental involvement in the learning process and hence a partnership between parents and teachers. This model seems to offer an efficient, educationally-relevant, and scalable system that involves parents, students and teachers. At this stage, information is not yet available about how the system is improving teaching and learning in the schools where it has been used. The project is worth monitoring over time, as it may point to ways in which the model can be replicated elsewhere in the region.

In a separate case, the value of pervasive mobile phone access in South Africa was demonstrated during a widespread teachers' strike for higher pay in August 2010. One of the teachers' unions used mobile phones to communicate during the strike, and teachers accessed strike updates on their mobile phones (SADTU, 2010). In addition, students used their mobile phones to access support for exam preparation. During the strike, students did not have access to classroom lessons because public schools across the country were shut down. The strike took place a few weeks before students were scheduled to take their year-end exams. To support students in exam preparation, volunteers communicated with Grade 12 learners via MXit, a chat platform with an estimated 27 million subscribers in South Africa that is particularly popular among South African youth. The platform enabled volunteer tutors to answer questions raised by students and to provide study materials for downloading (Humphrey, 2010). This example shows how mobile phones enabled spontaneous self-organizing communication and knowledge-sharing on a large scale, both among striking teachers and among students, in ways that can support learning outcomes.

BRIDGEIT IN TANZANIA

The BridgeIT project in Tanzania shows how mobile phones can act as conduits for the delivery of curriculum-centred video content within a classroom setting. In this case, teachers download educational videos via a local 2.5G or 3G mobile network to a smartphone that is connected to a television (TV) in the classroom. The video content, which covers subjects

such as human biology, geometry and HIV/AIDS, is developed by teachers, produced by a local video company and stored on the server of a local mobile network operator, Vodacom.

Teachers uses the mobile platform to deliver lessons by screening videos in the classroom and discussing the content with students. Teachers have access to a digital catalogue of educational videos that are typically four to seven minutes long. This short duration makes the content ideal for inclusion in a lesson that typically lasts for forty-five minutes. Within three years, the programme was able to reach 150 schools, 1,021 teachers and 60,540 learners, delivering 151 unique mathematics and science lessons and 32 life skills lessons. This project has reportedly produced positive educational outcomes. Students have shown improved motivation and test results, while teachers have benefited by having additional teaching materials available to them in class. In the past, teachers reportedly had one textbook to teach a subject to a class. In contrast, the videos allow an entire class to easily view diagrams and images, which helps students grasp the subject and better understand complex concepts in particular (Kasumuni, 2011).

ROAD TO READING IN MALI

Another example of how mobile phones support teachers in their delivery of curriculum through classroom practice is the Road to Reading programme in Mali, West Africa. This programme is organized by the Education Development Center (EDC), an international non-profit organization based in the USA. The project comprises a range of different educational activities, including a focus on teacher training. Lesson plans are posted on a blog site, and teachers use their own mobile phones to access the internet for online curricula to use in their classrooms. The EDC asks the teachers to provide feedback on the lessons by responding to a text-message survey. In 2010, the programme reached 500 schools and began planning expansion on a national scale. The EDC is also seeking to improve data collection to better analyse project outcomes. In addition to providing lesson plans, the group is exploring the possibility of posting sample tests for teachers to download and developing standard criteria for teacher evaluations.

The project is limited by the fact that teachers use their own mobile phones and so can only be involved in the programme if they have phones and internet access in their classrooms to download the online curricula. At the time of writing, an independent evaluation of this project was not available. However, it represents one of the few projects in Francophone West Africa targeted at teachers. Depending on the project's success, it may be useful to consider the its approach of assimilating externally-produced content into local classrooms to support teachers' instruction.

COMPARATIVE ANALYSIS

These three examples show how it is possible for mobile phones to support teachers in curriculum delivery, both in and outside of classrooms. The Radical Learning and MXit platforms in South Africa and the Road to Reading programme in Mali all offer lessons accessible via mobile phones for students and teachers to use on a one-to-one basis in formal classroom settings and informally outside of school hours. In contrast, the BridgeIT project in Tanzania delivers video content directly to the classroom for a whole class to view – in this case a one-to-many delivery scenario. This model is used solely in a classroom setting to support teachers' classroom practice. The BridgeIT example is valuable because it shows how

mobile phones can make media-rich content readily available to teachers on-demand for classroom use. This model is more cost-effective than the satellite data-cast solutions that have been explored in South Africa to make video content available on-demand in classrooms. It also more flexible than educational television programmes where video content is available only at particular times on particular days, as is the case for the private satellite TV company Multichoice that broadcasts educational programming via Digital Satellite Television (DSTV) across many countries in Africa.

It is significant that most lesson plans and online curricula offered via mobile phones can only be accessed through internet-enabled mobile phones that can download images, which are usually more costly than text-based messages. These higher costs and the need for a high-end mobile phone render content unavailable to the vast majority of teachers and learners, meaning that the role of mobile phones in supporting curriculum delivery is extremely limited at this stage. However, as smartphones and internet connectivity become more widely available and affordable, this situation may change. In the case of South Africa, another limiting factor is the cost of proprietary curriculum content that parents, schools and education departments must purchase. However, the recent emergence of OER in Africa may allow this barrier to be circumvented. OER are learning resources that are made available for open and free use and adaptation. The Southern African Institute for Distance Education (SAIDE) has developed a comprehensive multimedia series of OER that aims to develop teachers' abilities to use educational theory to improve their teaching practice. While these resources are not yet accessible via mobile phones, it seems likely that they will be adapted for mobile phone interfaces in the near future.

IMPROVING EDUCATIONAL MANAGEMENT AND ADMINISTRATION

A growing number of projects in AME use mobile phones to support mass communication with student-teachers enrolled in universities and teacher colleges, particularly in South Africa and Saudi Arabia (Altameem, 2011; Brown, 2005, Mostert, 2010). Mobile phones have also been used to improve the management of national education systems and increase communication between teachers and Ministries of Education. Some of the most relevant examples are discussed in the sections below.

CERTIFICATE IN EDUCATION COURSE AT AGA KHAN UNIVERSITY IN KENYA

Aga Khan University (AKU) is an international university with locations in eight countries, including Kenya and Tanzania. The university offers a certified course for student-teachers based on a blended model of face-to-face and practicum sessions. The course forms part of the Certificate in Education: Educational Leadership and Management (CE:ELM) programme based at AKU's teaching site in Kisumu, Kenya. The course relies on the availability of student-teachers' personal mobile phones, which are used to support course delivery using an SMS system. Instructors send SMS messages to student-teachers, who can text replies using their mobile phones. Students are also grouped in clusters to enable SMS conversations that facilitate peer support. The data flow and communication structure was designed such that messages can originate with students located at the course site or with instructors located in either Nairobi, Kenya, or Dar es Salaam, Tanzania. These messages are generally about course updates, meeting dates, and, more importantly, different aspects of the action-research process. The messages are received at a central message centre in Dar es Salaam, saved on

the NokiaBlogs software, and then rerouted to the appropriate instructor, student or group of students. Like the CED programme for distance learners in Mozambique, this course uses mobile phones more for communication purposes than as a learning platform.

UNIVERSITY COMMUNICATION SYSTEMS IN SOUTH AFRICA AND SAUDI ARABIA

As another example, Brown (2005) reported on the 2002 pilot project at the University of Pretoria in South Africa, in which mobile phones were used to provide both administrative and academic support to students in its education faculty, many of whom were student-teachers. Similarly, Altameem (2011) found that some universities in Saudi Arabia have adopted SMS for teaching and learning. He cited the example of King Saud University (KSU) in Riyadh, which initiated a new service in 2011 that allows individual students or groups of students to receive SMS messages from the university's management of faculties, schools or administrative divisions. The university's learning management system (LMS) integrates the pedagogical and administrative uses of the smartphones, tablet devices and laptops owned by students, faculty and administrative staff. In this case, the mobile learning system is an advanced, complex and integrated solution. Taking advantage of the fact that most students, teachers and administrators own more than one type of mobile device, the university is attempting to create a campus-wide, flexible LMS with a wide range of educational and administrative applications. Though not yet implemented, the envisioned system points to the potential for improved learning, teaching and administration once smartphones are widely available alongside other high-end mobile technologies (such as tablet devices and laptops) and the requisite technological infrastructure is in place.

SEMA IN KENYA

The SMS Education Management Application (SEMA) project in Kenya serves as a good example of the potential of mobile phones to improve efficiencies in data collection, information sharing and communication between teachers and Ministry of Education officials. SEMA was established as a pilot project in 2006 and ran for eight months. The mobile phone system was originally conceived as a study-support system for 200,000 in-service primary-school teachers who were part of the Kenyan Government's School Empowerment Programme (SEP). The original focus was on sharing information about lesson modules and tips, as well as reminders about deadlines and schedules. Teachers tended to use the system to access and manage logistical information rather than content-related material, which influenced its evolution from a study-support system to an information management system that allowed teachers and MOE officials to communicate, collaborate and collect data quickly, easily and efficiently. For example, the system was used to collect gross-enrolment data that drives budget allocations for each school. SEMA was designed to demonstrate that a monthly version of this kind of data (i.e. the number of students in classes sorted by age and gender, and teacher-to-student ratios) could be collected and sent by teachers via SMS directly to the MOE's Education Management and Information System (EMIS).

While the project was generally successful in developing an EMIS support system on a mobile SMS platform, it also encountered organizational and technical challenges, including many technical errors. As one of the few large-scale mobile-enabled projects targeted at teachers in the AME region, SEMA offers several lessons about the design of large-scale programmes using low-end mobile phones. One of the key findings of the project's independent evaluation was that it needed clearly-identified 'champions' within the MOE who would be responsible

for leading the project. It also needed to develop an authoritative policy and guidelines for the use of the system by teachers and government officials.

ENABLING PEER SUPPORT

This review also found evidence of how mobile phones can facilitate peer support among teachers, most notably in the Teaching Biology Project (TBP) established in Cape Town, South Africa, in 2010. The project hosts three in-service teacher-training workshops per year, targeted at biology teachers. These workshops aim to improve teachers' knowledge of evolutionary biology and to allow them to network with other teachers from a range of schools. Teachers use the workshop to develop resource materials in collaboration with other teachers and conduct laboratory activities they can implement in their classrooms. The workshops also focus on developing the teachers' ICT skills by allowing them access to PC labs designed to support the development of lesson plans and assessment materials using ICT (TBP, 2011).

The project has also explored the use of mobile phones in teacher training. At the outset, discussions with eleven teachers revealed that they were interested in receiving motivational, administrative and content-specific SMS messages, and in being able to chat or connect with one another via SMS. The project uses weekly SMS messaging to send biology-related messages to teachers. These include messages related to the definitions of biological processes, motivational messages such as wishing teachers well for exams, and administrative messages. Teachers have indicated that this is a useful service. The positive response from teachers on the use of SMS messaging was reported at one of the three annual workshops.

The project also uses the online chat platform MXit, but because it does not work on some phones, and problems were experienced in the private chat rooms that were set up, it is not the only platform the project uses. Teachers agreed, however, that it would be an ideal platform to communicate biology messages to learners because it is so popular among youth in South Africa. The project also established a Facebook page and a Twitter account, which are accessible by mobile phone. The Facebook page is more popular than Twitter among the teachers. They use the page to discuss various topics such as being behind in the curriculum schedule, feeling overwhelmed by the teaching workload, and planning the types of exam papers that students will need to write. Teachers also use the page to share resources such as exam exemplars, definitions and links (S. Vosloo, personal communication, October 2011).

This project highlights the extent to which mobile phones that can access social media sites such as Facebook and Twitter can be valuable in providing peer support among teachers and developing a community of practice. The fact that teachers responded positively to the SMS messaging service shows that it is possible to successfully employ this type of approach using low-end phones and teachers' local languages. The project outcomes also reflect teachers' need for moral support and knowledge-exchange among their peers, especially in light of the pressures and heavy workloads they have to manage. From the project report it appears that the opportunity to engage as a community, both face-to-face and virtually through mobile phones, played an instrumental role in consolidating collaboration among these teachers, while at the same time building their confidence in the use of technologies and virtual spaces (S. Vosloo, personal communication, October 2011).

SUPPORTING TEACHER TRAINING

Most education programmes and projects in AME use 'teacher training' to refer to the development of in-service teachers' skills. For the purposes of this paper, teacher training refers to one-off, topic-led, short-term training programmes that aim to develop specific skills but do not necessarily adhere to professional standards for competency development. Most teacher training programmes in Africa aim to promote the development of basic ICT skills, often as an end in itself. Sometimes, however, ICT literacy or ICT skills training also include the application of ICT as a tool to support learning and teaching (Isaacs, 2006). In the case of mobile phone-enabled projects, less time is devoted to training teachers on how to use mobile phones, and more emphasis is placed on how mobile learning platforms can be integrated into instructional strategies.

MOMATH IN SOUTH AFRICA

The Nokia Mobile Mathematics (MoMath) project, which commenced in 2007, aims to improve the mathematics performance of Grade 10 learners in South Africa. The focus of the project was to have learners use mobile phones to access curriculum-aligned mathematics content and to participate in competitions, quizzes and peer-learning based on lessons related to mathematics. While the project relies on students and teachers using their own or shared mobile phones, it also provides schools with a 'mobikit', which is a lockable case of ten mobile phones per school to allow learners who do not have access to a mobile phone to borrow one while at school. The project began with 260 learners in 3 provinces of South Africa. In 2010, after having reached 4,000 learners, 72 teachers and 30 schools, the project moved on to a second phase. By the end of 2011 the project had reached 25,000 learners, 500 teachers and 172 schools in 4 provinces of South Africa.

Learners and teachers access the curriculum content via a low-cost proprietary chat platform hosted by a private company called MXit that is very popular among South African youth. Free access is supported by South Africa's three local mobile network operators. To complement the mobile platform, a dedicated website using Moodle, an open-source LMS, allows students and teachers to track progress and activities on the web. The site also allows teachers to assign and monitor homework with little extra effort. The system makes it easy for teachers to see which students are having problems and identify areas that are causing difficulties. Teachers receive a two-day orientation training session, taught by project team members and teachers who were involved in the initial pilot phase. A curriculum advisor from the local district education authority provides further support. The teachers can also use the exercises and theory lessons in a classroom even if the students do not have mobile phones, and make use of the tests to develop ad hoc exams (Naidoo, 2011).

An initial evaluation of the project revealed that 79% of the teachers who were trained felt that the two-day teacher training equipped them with everything they needed to know about the project. They reported this immediately after the training session and confirmed the same view six months later. By the end of the second term of using the service, most teachers also agreed that the project had a significant impact on their students' attitudes toward mathematics, as well as on their own roles as math teachers. The majority of teachers and principals in the case-study schools indicated that they would like to continue using the service beyond the trial period (R. Vänskä, personal communication, September 2011).

This project demonstrated that teacher training in the integration of mobile phones into mathematics instruction can work well on a short-term, one-off basis. In the MoMath model, teachers were directly trained by specialists, in contrast to the cascade model of training adopted by the SEMA project in Kenya, which involves the training of teachers who in turn train additional teachers. The SEMA project experienced the challenges that typically accompany the cascade model, namely that the designated teacher-trainers have a limited capacity to deliver adequate training.

ENHANCING PROFESSIONAL DEVELOPMENT

In contrast to teacher training, continuing teacher professional development refers to a more systematized, continuous and coherent process of professional development for educators in accordance with professional competency standards and frameworks. CTPD also includes training in the evolution and change of the teaching profession and education systems as a whole. The teaching profession is currently being transformed by the integration of new technologies in education, and CTPD can provide teachers not just with basic ICT skills but also the pedagogical and innovative skills to leverage technology to improve learning and teaching both in and outside of classrooms (Isaacs, 2006).

From a professional development perspective, the teacher is also a learner, more specifically an adult learner, and the use of mobile phones for teacher development is another form of mobile learning. This review, however, found little evidence of mobile learning in CTPD at the pre-service and in-service levels. At the pre-service level, the Ministry of Education in Mozambique has embarked on a Technology Plan for 2012 targeted at teachers enrolled in teacher-training colleges. The plan includes the large-scale use of mobile phones to enable teachers to access curriculum content that has been adapted for the local cultural and linguistic contexts in which they will be teaching. The model incorporates the use of mobile phones alongside established PC labs in teacher-training colleges across Mozambique. At present however, this intervention is still in its design stage, with implementation planned in 2012. It is therefore premature to discuss the nature and extent of this initiative and the effect it might have on pre-service teachers.

One example of a CTPD programme for in-service teachers is the Advanced Certificate of Education (ACE) offered by Stellenbosch University in South Africa. The ACE programme is a two-year learning module that offers accredited qualification for in-service teachers who want to build their content knowledge and pedagogical skills. The programme allows teachers to specialize in different subjects such as mathematics (AIMSEC, n.d.). In 2009 the ACE programme was offered in a new format that incorporated a mobile phone-enabled blended learning model based on Moodle, an open-source learning management system with a mobile interface. The LMS was used by both the remaining thirty-three second-year student-teachers and the forty-three first-year student-teachers at the time. An evaluation of this intervention concluded that while the majority of teachers accessed the LMS via a computer, incorporating a mobile interface allowed some teachers to participate in peer discussions that would not have been possible otherwise. The evaluation further suggested that the mobile interface paved the way for 'alternative teaching and learning methodologies' and enabled increased interaction between student-teachers and lecturers (Mostert, 2010). Unfortunately the evaluation report does not elaborate further on the nature or effect of these alternative, mobile-enabled methodologies. The project does show, however, that attempts at integrating

mobile phones into CTPD delivery are underway in region, albeit only in a nascent stage. The project's challenges also point to the distance that still needs to be travelled in order to mainstream mobile learning as part of the ongoing professional development of AME teachers.

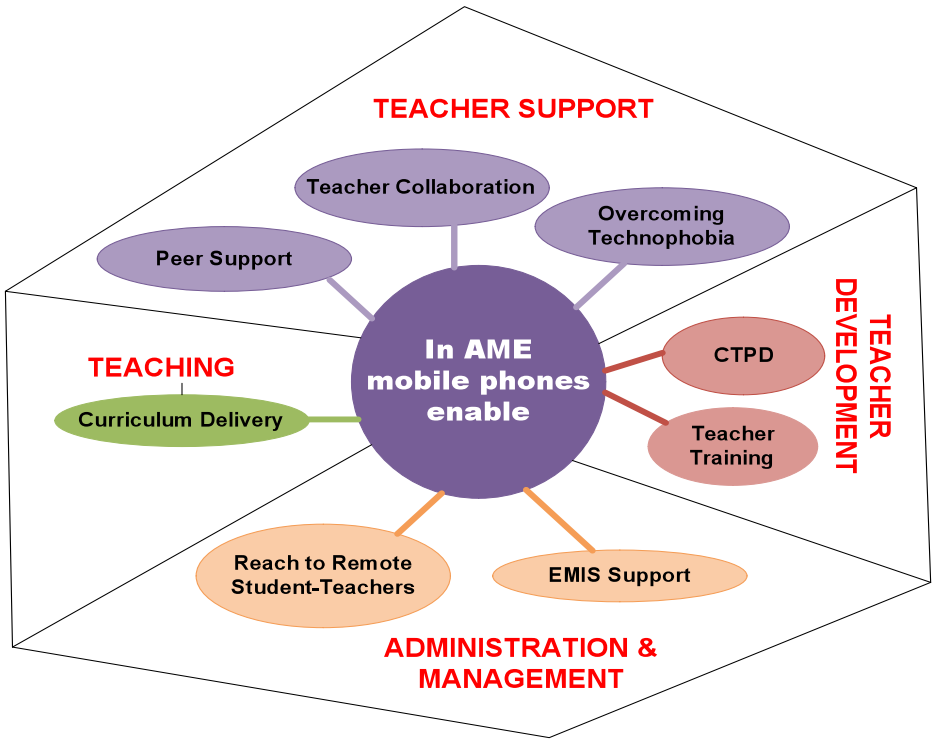
STRENGTHENING TEACHER COMPETENCIES

Competencies refer to the knowledge, skills, abilities and behaviours required to perform particular job functions. Conversations about contextually-relevant competencies required by AME teachers to integrate ICT into classroom practice have spurred animated debate. Disagreements underscore the absence of regionally-relevant, unified standards on teacher competencies. In this context, UNESCO's ICT Competency Framework for Teachers – which includes mobile technologies among educational ICTs – and the work conducted by the International Institute for Capacity Building in Africa (IICBA) on standards for African teachers, serve as valuable guidelines for the development of unified competency standards on ICT integration for AME teachers.

ANALYSIS OF MOBILE LEARNING INITIATIVES

The above sections provide a succinct overview of the limited ways in which mobile phones are being used to support teachers in AME. Figure 2 summarizes the areas of teaching, teacher support, teacher development, and administration and management for which mobile phones can play an enabling and supportive role.

Figure 2. Mobile support functions for teachers in AME



The overview of initiatives also reflect a continuum of technological, management and educational capabilities and services. On one end are projects that use low-end mobile phones and voice or text-based platforms. Here the focus is less on education-related services and more on communicating, sharing and managing information via SMS. The example of student-teachers studying at the CED in Beira, Mozambique is a case in point. On the other end of the spectrum, at King Saud University in Riyadh, Saudi Arabia, student-teachers predominantly use smartphones that will soon be integrated into a functionally-rich learning management system that includes additional supportive mobile technologies such as tablet devices and laptops. While this LMS is still in the design phase, it reflects a high level of integration between the technological, educational and administrative spheres, offering an array of services to the students, faculty members and administrative staff of KSU (Altameem, 2011).

Do these mobile learning initiatives, from Beira to Riyadh, adequately address the systemic crisis in the sustainable supply, retention and quality of teachers in the region? This question lies at the heart of the challenge to meet EFA goals in Africa and the Middle East. Unfortunately the answer is that the evidence illustrated in this review is too sparse and too shallow to be conclusive. The data provided are largely untrustworthy and lack credibility because they are predominantly based on anecdotal, descriptive and promotional information. As a result, many of the opportunities that mobile learning offers for improving the teaching systems in the region remain speculative and are based largely on perceived potential.

FACTORS INFLUENCING MOBILE LEARNING FOR TEACHERS

A number of factors influence both the current status of mobile learning initiatives in the teacher-development sector and their perceived potential. The sections below explore the primary drivers, enablers and barriers to mobile learning for teachers in AME.

DRIVERS AND ENABLERS

Projects that explore the efficacy of mobile phones to support teachers are developed in response to low-performing education systems, poor-quality teaching in classrooms and a lack of educational resources to support learners in the region. This situation drives the search for new and innovative ways to improve the system. The BridgeIT project in Tanzania, for example, was designed with the objective of improving the quality of both educational content and teaching. In the case of the Teaching Biology Project in South Africa, the project was driven by the need to raise awareness among biology teachers of the educational value of mobile phones. Here the emphasis was on showing teachers how mobile phones can enable access to content and pedagogical information related to teaching biology as a subject, as well as how mobile phones can enable peer support among teachers and help them build a community of practice. TBP's underlying motivation is to improve the quality of learning and teaching in a particular school-based subject, in this case biology (S. Vosloo, personal communication, October 2011).

Similarly, the MoMath project in South Africa was driven by the goal of improving the quality of learning in mathematics. Teacher training was included in this project in order to complement and support a learner-centred programme. Teachers were shown how students would learn mathematics on their own and in peer collaboration enabled by the mobile phone. They were trained to motivate and support students, challenge students through quizzes, and encourage students to participate in mathematics competitions through the programme. The following SMS sent to a MoMath teacher exemplifies the type of follow-up messages teachers receive:

> Dear Educator, I am excited to inform you that our competition will have one topic only: TRIGONOMETRY. Remember the competition will take place on 29 August 2011 from 08h00 to 20h00. There will be 7 Questions: 3 easy; 2 medium; and 2 challenging/hard. Random questions to the competition will be asked. So encourage your learners to practice easy, medium and hard ones. LEARNERS WILL BE ALLOWED TO TRY THE COMPETITION ONCE! Regards, Solane-SchoolNet. (Naidoo, 2011, p. 2)

In addition to the need to improve the quality of teaching and learning, the demand for more efficient and effective management of school systems is also a key driver in the use of mobile phones in education. The SEMA project in Kenya was established with the goal of improving efficiency in implementing the Kenyan Government's policy on providing free universal

primary education for all children of primary-school age. This efficiency imperative also drove the mobile phone initiatives in universities across the AME region.

In all cases, the widespread availability of mobile phones enables mobile learning programmes to be more self-organizing and less dependent on highly centralized coordination and management, in contrast to government-initiated laptop programmes, for example. For much of the past two decades, ICT in education interventions in the AME region placed emphasis on access to PC laboratories in classrooms, which required significant investment in coordination, planning, distribution and technical support. For example, it has taken South African authorities three years to effectively implement a teacher laptop project that was set out to target 365,000 teachers. Many teacher still do not own laptops through this programme. Yet many if not all have their own mobile phones. The ease of individualized access to mobile phones enables greater autonomy at the user level and does not require high levels of management and support.

Finally, the initiatives in this review have all been enabled significantly by the fact that most teachers already possess their own mobile phones. All of the projects reviewed, with the exception of the MoMath project, worked with the level of mobile phone ownership already available, rather than purchasing phones for teachers. The MoMath project provided ten mobile phones per school to support those who did not have mobile phones, but this was peripheral to its core mobile phone access strategy, which, like the other projects reviewed, relied mainly on teachers' and learners' personally-owned mobile devices.

BARRIERS

The low number of mobile learning projects in the AME region could be attributable to a number of constraining factors that impede the widespread integration of mobile phones in teacher development. These include technological and economic barriers as well as social barriers related to peoples' attitudes and perceptions about mobile phones in education.

Access to mobile telephony is not yet universal. While the Middle East region reached a 96% mobile penetration rate in 2011 with a number of countries exceeding the 100% mark, some countries in sub-Saharan Africa still face low penetration levels (Enzer, 2011). Access to smartphones remains low, although this may change as the cost of handsets with increased functionality declines over time. Research conducted by Informa Telecoms & Media found that, at the end of 2009, only 5.1% of mobile subscribers in Africa had smartphones, which reflects one of the lowest penetration levels for smartphones in the world (BizTech Africa, 2011). Furthermore, gender disparities in access still prevail, which, according to Research ICT Africa, are mainly caused by socio-economic disparities such as uneven income levels between men and women (Gillwald et al., 2010).

The lack of awareness among teachers about the positive educational value that mobile phones can add, and a generalized conservatism toward the use of mobile phones by young people, also serve as inhibiting factors. For example, in South Africa a few cases reported in the media suggested that students were using their mobile phones to send 'bullying' messages to other students, cheat on tests using SMS messaging, and access pornographic materials and

sex chat rooms. These reports have influenced teachers' perceptions of mobile phone use by their students and have led many educators to support the banning of mobile phones from schools.

This negative attitude is not helped by the lack of leadership on mobile learning from government Ministries of Education, which are constrained by limited human and financial capacities. MOEs in the region are invariably involved with the roll-out of ICT access in schools and universities, and perhaps their preoccupation with traditional models of ICT in education has not yet provided the space for exploring the efficacy of mobile phones to support educational outcomes.

This review has also shown that mobile learning has not yet been institutionalized or mainstreamed within national teacher development systems. At the pre-service level, mobile phones are not integrated into teacher education programmes offered by teacher-training institutions. Mobile learning is also not incorporated into subsequent phases of teacher development for in-service teachers. Presently, the inclusion of mobile phones in teacher training and development depends solely on project-based interventions or the ingenuity of individual teachers.

RECOMMENDATIONS

This section presents recommendations to inform the good design of mobile learning interventions for teachers in AME, based on the lessons learned from previous mobile learning initiatives in the region. This review has shown the value of combating conservatism among teachers about technology in general and mobile phones in particular. This can be done through awareness-raising programmes and advocacy on the value of mobile phones in providing teacher support, and well as through improved teacher training and CTPD programmes focused on the role of mobile phones in supporting teaching and learning. The Teaching Biology Project in South Africa provides a good example of how this was accomplished successfully. It is important for researchers and educators to develop a value proposition for mobile learning for the teaching community in the region. This can be done in conjunction with efforts to build the evidence base on how mobile phones can support teacher recruitment and retention, CTPD, and the delivery of high-quality instruction.

An important component of such a case-building endeavour is research on how mobile phones can enable institutional efficiencies among teacher-training institutions and improve their ability to deliver CTPD. TTIs should be encouraged to initiate mobile learning programmes that involve their lecturers, administrators and student-teachers, and to forge partnerships with local network operators and content providers. As part of a partnership development programme, content providers can be encouraged to make their content accessible on mobile phones. The growth of OER in the AME region also opens up prospects for exploring how these resources can be made accessible through mobile applications. The approach adopted by King Saud University in Saudi Arabia, which involves different stakeholders in the development of an integrated learning management system enabled by mobile phones, is worth exploring among TTIs in more resource-poor environments.

At the same time, the design of mobile learning interventions for teachers should also take advantage of the individualized, personalized and informal ways in which teachers can use mobile phones for their own learning and for peer support. By focusing initially on informal learning, interventions engage with the simplicity that mobile phones enable and are not hamstrung by the institutional inefficiencies that often exist due to severe capacity constraints. However, it is important to keep in mind that peer support may have its limitations. When designing teacher-training models for integrating mobile phones into education, projects like SEMA in Kenya have experienced some difficulties with the cascade model, which relies on newly trained teachers to support and train their colleagues. It may be worthwhile to consider alternative training approaches that draw on self-directed, self-paced learning models for teacher competency development, which are well-suited for a mobile phone environment.

Finally, the paucity of mobile learning projects focused on teachers, and the small-scale and experimental nature of most of the projects highlighted in this review, reflect a need to strengthen the broader policy environment around mobile learning, in order to enable more programmes and projects aimed at teacher support. Policies should include clear guidelines on the use of mobile learning for teachers, including acceptable use policies accompanied by working practices that demonstrate how such policies might be implemented in support of mobile learning in schools.

CONCLUSION

The story of how mobile phones can support teachers, teaching and teacher development in Africa and the Middle East has evidently just begun, and for now, only the prelude is available. At both the conceptual and practical levels, mobile learning in support of teacher development is still in its infancy in this region. At this embryonic stage, there are glimpses of how the rapid evolution of mobile phones can and will catalyse pedagogical changes in education systems across the region in the future. It will be important to monitor and attempt to shape how these changes transpire over time, as therein may lie the potential to meet the global challenge of providing universal, equitable access to quality education for all.

This review demonstrates that there is still a wide gap between experience and understanding in the field of mobile learning in support of teachers. How mobile phones can be effectively integrated in the existing teacher development landscape, and how mobile technologies will change this landscape, is still largely open to debate. The review provides a snapshot of mobile learning in support of teachers in AME, aimed at informing practitioners and policy-makers about how the landscape is changing and what developments may be possible through more conscious intervention. Available evidence, though largely anecdotal, implies that it is theoretically possible to use mobile phones in support of the sixth EFA goal of improving the quality of education for all. The challenge remains to increase the body of evidence on mobile learning in order to make a more convincing case for the inclusion of mobile phones in teacher development in AME.

The increasing availability of mobile learning opportunities in the context of the emergence of a generalized mobile society arguably makes it more possible than ever before to resolve many of the educational challenges in the AME region. However, on its own mobile learning does not offer a panacea for the endemic crisis in the region's education systems. It can only be effective as part of a sustained endeavour to address this crisis at all levels in the system. Two decades of ICT in education interventions in the region have shown that, among other factors, political will and leadership are crucial ingredients for success. Leadership at all levels can make a significant difference as mobile learning emerges more visibly on the African and Middle Eastern educational horizon in the future (Mourshead et al., 2010).

REFERENCES

African Institute for Mathematical Sciences School Enrichment Centre (AIMSEC). n.d. *Advanced Certificate in Education*. https://aimssec.aims.ac.za/en/programmes/ace (Accessed 30 January 2012.)

Agbatogun, A. O. 2010. Self-concept, computer anxiety, gender and attitude towards interactive computer technologies: A predictive study among Nigerian teachers. *International Journal of Education and Development Using ICT*, Vol. 6, No. 2, pp. 1–14. Bridgetown, IJEDICT. http://ijedict.dec.uwi.edu/viewarticle.php?id=894

Altameem, T. 2011. Contextual Mobile Learning System for Saudi Arabian Universities. *International Journal of Computer Applications,* Vol. 21, No. 4. pp 21–26. New York, Foundation of Computer Science (FCS). http://www.ijcaonline.org/volume21/number4/pxc3873377.pdf

BizTech Africa. 2011. Africa lags smartphone market. *BizTech Africa*, 4 November 2010. http://www.biztechafrica.com/article/smartphones-drive-data-traffic-africa-lags/300/

Brown, T. H. 2005. Towards a model for m-learning in Africa. *International Journal on E-Learning*, Vol. 4, No. 3, pp. 299–315. Norfolk, Va., Association for the Advancement of Computing in Education (AACE).

Cherrayil, N. K. 2010. Mobile subscriptions in Middle East to cross 300m. *Gulf News*, 2 December 2010. Dubai, Al Nisr Publishing. http://gulfnews.com/business/telecoms/mobile-subscriptions-in-middle-east-to-cross-300m-1.721749

Department of Education (DOE). 2009. *Teacher Laptop Initiative*. Government Gazette, Vol. 527, No. 32207, 8 May 2009. Republic of South Africa. http://www.elrc.org.za/UploadedDocuments/Teacher%20lap%20top%20initiative%20FINAL%20GOV%20GAZETTE%20version%20for%20media.pdf

Diligent, L. 2011. Teaching Conditions Faced by Teachers in the Rural Middle East and North Africa. *Dilemmas of an Expat Tutor*. http://expattutor.wordpress.com/2011/11/22/teaching-conditions-faced-by-teachers-in-the-rural-middle-east-and-north-africa/ (Accessed 29 January 2012.)

Enzer, G. 2011. Middle East has 96% mobile penetration. *ITP.net*, 21 November 2011. http://www.itp.net/587107-middle-east-has-96-mobile-penetration (Accessed 30 January 2012.)

Ernst and Young. 2010. *An Evaluation of the XO on Windows Pilot Project in Rwanda*. Johannesburg, Microsoft and Ministry of Education Rwanda.

Fanni, F., Rega, I., Van Zyl, I., Tardini, S. and Cantoni, L. 2010. *Investigating Perception Changes in Teachers Attending ICT Curricula through Self-Efficacy*. Lugano, Switzerland, New Media in Education (NewMinE) Lab, Università della Svizzera italiana. http://www.gg.rhul.ac.uk/ict4d/ictd2010/posters/ICTD2010%20Fanni%20et%20al.pdf

Fripp, C. 2010. AU Applauds ICT Growth In Africa. *IT News Africa*, 30 January 2010. http://www.itnewsafrica.com/2010/01/au-applauds-ict-growth-in-africa/ (Accessed 12 October 2011.)

Ghafour, P. K. A. 2011. Saudi woman teacher excels at MEA education forum. *ArabNews.com*, 20 September 2011. http://arabnews.com/saudiarabia/article504388.ece (Accessed 7 January 2011.)

Gillwald, A., Milek, A. and Stork, C. 2010. Gender Assessment of ICT Access and Usage in Africa. *Towards Evidence-based ICT Policy and Regulation*, Vol. 1, Policy Paper 5. Cape Town, Research ICT in Africa. http://www.researchictafrica.net/publications/Towards_Evidence-based_ICT_Policy_and_Regulation_-_Volume_1/RIA%20Policy%20Paper%20Vol%201%20Paper%205%20-%20Gender%20Assessment%20of%20ICT%20Access%20and%20Usage%20in%20Africa%202010.pdf

Graham, I. 2012. CAPS: using cell phones to assist teachers and parents. *e4Africa*, 14 January 2012. http://www.e4africa.co.za/?p=4228 (Accessed 16 January 2012).

GSM Association (GSMA) and A.T. Kearney. 2011. *African Mobile Observatory 2011: Driving Economic and Social Development through Mobile Services*. London, UK, GSMA. http://www.mobileactive.org/files/file_uploads/African_Mobile_Observatory_Full_Report_2011.pdf (Accessed 11 October 2011.)

Henzinger, G. 2011. *Delivery of offline digital material with video, audio and e-book via CD/DVD to distance learners in central and northern Mozambique*.

Humphrey, B. 2010. MXit captivates young cellphone users. *Mail & Guardian Online*, 21 October 2010. http://mg.co.za/article/2010-10-21-mxit-captivates-young-cellphone-users

Isaacs, S. 2006. *Towards a GeSCI Initiative on Teacher Professional Development in Africa*. Internal GeSCI Report. Dublin, Global e-Schools and Communities Initiative (GeSCI). http://www.gesci.org/assets/files/Towards%20a%20GeSCI%20initiative%20on%20TPD%20in%20Africa.pdf

Kasumuni, L. 2011. Delivering video by mobile phone to classrooms in Tanzania. *eLearning Africa News Portal*, 18 April 2011 http://www.elearning-africa.com/eLA_Newsportal/delivering-video-by-mobile-phone-to-classrooms-in-tanzania/ (Accessed 20 January 2012.)

Mafenya, N. P. 2011. *Increasing Throughput and Success Rate in Open and Distance Learning Using Mobile Technology: A Case Study*. Johannesburg, South African Institute for Distance Education (SAIDE).

Mbuvi, D. and Ochieng, Z. 2010. Teachers to get laptops with financing under new PPP. *CIO East Africa*, 20 August 2010. http://www.cio.co.ke/news/main-stories/Teachers-to-get-laptops-with-financing-under-new-PPP (Accessed 23 December 2011.)

Mostert, I. 2010. *Incorporating a mobile interface in a blended learning programme for Mathematics teachers*. Paper delivered at the eLearning Africa 2010 Conference in Lusaka, Zambia. http://academic.sun.ac.za/kol/Ingrid%20Mostert%20Extended%20Abstract%20for%20SOTL.pdf

Mourshead, M., Chijioke, C. and Barber, M. 2010. *How the world's most improved school systems keep getting better.* New York, McKinsey & Company. http://mckinseyonsociety.com/downloads/reports/Education/How-the-Worlds-Most-Improved-School-Systems-Keep-Getting-Better_Download-version_Final.pdf

Naidoo, O. 2011. *Nokia MoMaths Project Report. May 2011–August 2011*. Johannesburg, SchoolNet South Africa and Nokia. http://www.schoolnet.org.za/reports/1108_nokia.pdf

Otto, L. 2011. Bringing development to Africa: How the mobile phone industry is helping. *Consultancy Africa Intelligence*, 2 December 2011. http://www.consultancyafrica.com/index.php?option=com_content&view=article&id=914:bringing-development-to-africa-how-the-mobile-phone-industry-is-helping&catid=82:african-industry-a-business&Itemid=266 (Accessed 31 January 2012.)

Perraton, H. 2007. *Open and distance learning in the developing world*, 2nd edn. London, Routledge.

————. 2010. *Teacher Education: the Role of Open and Distance Learning*. Vancouver, BC, Commonwealth of Learning (COL). http://www.col.org/PublicationDocuments/pub_TeacherEd_Role_ODL.pdf

SchoolNet South Africa (SA). 2011. *Microsoft Innovative Teacher Forum Awards: 2007 Finalists*. http://schoolnet.org.za/itf/2007finalists.htm (Accessed 19 January 2012.)

South African Democratic Teachers Union (SADTU). 2010. *Latest on Wage Negotiations*. http://www.sadtu.org.za/node/203 (Accessed 18 January 2012.)

Teaching Biology Project (TBP). 2011. *About*. http://www.facebook.com/teachingbio?sk=info (Accessed 31 January 2012.)

Touré, K. 2008. Introduction: ICT and Changing Mindsets in Education. K. Toure, T.M.S. Tchombe and T. Karsenti (eds), *ICT and Changing Mindsets in Education*. Bamenda, Cameroon, Langaa; Bamako, Mali, ERNWACA / ROCARE, pp. 8–13. http://www.rocare.org/ChangingMindsets/pdf/PREFACE-ICTandChangingMindset.pdf (Accessed 13 December 2011.)

UNESCO. 2005. *Towards Knowledge Societies*. Paris, UNESCO. http://unesdoc.unesco.org/images/0014/001418/141843e.pdf (Accessed 11 October 2011.)

———. 2010. *EFA Global Monitoring Report 2010: Reaching the marginalized*. Paris, UNESCO. http://unesdoc.unesco.org/images/0018/001866/186606e.pdf (Accessed 10 October 2011.)

———. 2011. *EFA Global Monitoring Report 2011. The hidden crisis: Armed conflict and education*. Paris, UNESCO. http://unesdoc.unesco.org/images/0019/001907/190743e.pdf (Accessed 10 October 2011.)

UNESCO Institute of Statistics (UIS). 2009. *Data Centre*. http://www.uis.unesco.org/Pages/default.aspx

Today there are over 5.9 billion mobile phone subscriptions worldwide, and for every one person who accesses the internet from a computer two do so from a mobile device. Given the ubiquity and rapidly expanding functionality of mobile technologies, UNESCO would like to better understand their potential to improve and facilitate learning, particularly in communities where educational opportunities are scarce.

This paper examines how mobile learning can support teachers and improve their practice in Africa and the Middle East. It reveals important lessons for policy-makers and other stakeholders seeking to better leverage mobile devices to assist the work of educators. Four additional papers review how mobile technologies are being used to help teachers in other regions of the world: Asia, Europe, Latin America, and North America. A 'Global Themes' paper synthesizes findings running across the five regional papers.

Complementing the papers about teacher support is a separate set of six papers which describe illustrative mobile learning initiatives and their implications for policy. These papers are also organized geographically.

Two 'Issues' papers will be added to the Series later in 2012. One will anticipate the future of mobile learning, and another will articulate considerations for creating policy environments in which mobile learning can thrive.

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