



United Nations
Educational, Scientific and
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MOBILE LEARNING AND POLICIES

KEY ISSUES TO CONSIDER

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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:
<http://www.unesco.org/new/en/unesco/themes/icts/m4ed/>

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This paper is part of the larger UNESCO Working Paper Series on Mobile Learning. Francesc Pedró conceived of the Series, and Steven Vosloo and Mark West coordinated and completed day-to-day work on the project. Additional input was provided by a number of UNESCO education specialists, particularly David Atchoarena, Fengchun Miao, Diane Boulay and Jongwon Seo, as well as UNESCO's partners at Nokia, notably Riitta Vänskä. At UNESCO, Marie-Lise Bourcier deserves special mention for her valuable assistance. Finally, Rebecca Kraut made outstanding editorial contributions to the Series.

TABLE OF CONTENTS

ABOUT THE SERIES	3
ACKNOWLEDGEMENTS	4
INTRODUCTION	7
Context for mobile learning	
Mobile learning: A policy vacuum	
DEFINITION OF MOBILE LEARNING	10
ICT IN EDUCATION POLICIES	11
Transition to an information society	
Mobile learning in relation to existing ICT policies	
MOBILE LEARNING POLICIES: GUIDING PRINCIPLES	13
Leverage existing investments	
Localize policies	
Support open technical standards	
Promote intersectoral cooperation and multistakeholder partnerships	
Establish policies at all levels	
Review and update existing policies	
Ensure inclusive education	
INFRASTRUCTURE, CONNECTIVITY AND TECHNOLOGY PROVISION	19
Infrastructure and connectivity	
Universal access	
Network infrastructure	
Cloud computing	
Technology provision	
Provided mobile devices	
Bring Your Own Technology (BYOT)	
Shared expense plans	
e-Waste	
COSTS AND FUNDING	24
Taxation	
Competition	
Subsidized access	
Funding	
TEACHING, LEARNING AND EDUCATION PLANNING AND MANAGEMENT	28
Content	
Optimize content for mobile devices	
Adapt national education portals for mobile access	
Make content available to all	
Develop locally relevant content	

Learning contexts

- Formal learning
- Informal and non-formal learning

Curriculum and assessment

- Mobile literacies

Professional development

Education planning and management

INCLUSIVE AND SAFE EDUCATION 37

Inclusive mobile learning

- Gender equality
- Accessibility for learners with disabilities

Safe mobile learning

- Privacy protection
- Online safety and problem behaviour
- Digital citizenship and literacy
- Health concerns

Change management and advocacy

CONCLUSION 44

REFERENCES 46

CONTEXT FOR MOBILE LEARNING

UNESCO believes that information and communications technology (ICT) has great potential to facilitate knowledge dissemination, improve learning and assist the development of more efficient education services. ICT can extend educational opportunities to marginalized groups; increase education quality; and reduce inequalities based on gender, class, race, age and disabilities.

For the first time in history, a majority of people can afford to buy personal ICT in the form of mobile devices, in particular mobile phones. At the end of 2011 there were almost 6 billion mobile phone subscriptions worldwide (ITU, 2011). Increasingly growth is driven by developing countries, which accounted for over 80% of new mobile subscriptions in 2011 (ITU, 2012). Africa, which had only 200 million connected mobile devices in 2006, is estimated to have 735 million by the end of 2012 (GSMA and A.T. Kearney, 2011). This rapid expansion is likely to continue: currently Africa is the fastest growing and second-largest market for mobile phones. In addition to phones, other mobile devices are also making inroads in developing countries. Thailand, Turkey and Russia have all announced ambitious plans to roll out tablet computers for schools (Trucano et al., 2012). Despite being relatively unknown as a device category before 2010, tablet computers are expected to start outselling personal computers (PCs) as early as 2016 (NPD, 2012). Given the ubiquity and rapidly expanding capabilities of mobile devices, there is increasing interest in how they can support teaching and learning and advance UNESCO's Education for All (EFA) goals agreed to by 164 countries in 2000 (UNESCO, n.d.). A growing body of evidence gives empirical foundation to this interest. Numerous projects around the world have shown that mobile technologies can facilitate learning, help teachers work more effectively, and aid the operations of large education systems. Specifically, to cite only a few examples, projects have shown that mobile phones can provide access to distance education for teachers in remote areas of Mozambique, assist the development of literacy among girls in Pakistan, motivate young people in South Africa to read and improve their mathematics skills, promote literacy among adult women in Niger, strengthen communication systems between principals and teachers in Kenya, and enhance learning management systems in Mongolia. These and many other educational and administrative benefits of mobile technologies are described in the UNESCO Working Paper Series on Mobile Learning (Deriquito and Domingo, 2012; Dykes and Knight, 2012; Fritschi and Wolf, 2012a–b; Hylén, 2012; Isaacs, 2012a–b; Jara et al., 2012; Lugo and Schurmann, 2012; So, 2012).

As increasingly powerful mobile devices continue to saturate rich and poor communities alike, advances in mobile learning – learning using mobile technologies – are likely to accelerate. A growing number of initiatives are demonstrating ways in which mobile phones can help confront existing educational challenges and pioneer new strategies for learning (McKinsey & Company and GSMA, 2012). Designers of mobile learning projects are sharing best practices and carving out more sustainable models of implementation, moving away from the many small and short-lived pilot projects of the early 2000s. Simultaneously, the

prices of mobile devices and services are plummeting around the world. Just a decade ago a mobile phone was appropriately seen as a luxury item; today it is generally considered a staple of day-to-day life in communities as varied as Tokyo and Dakar. The research and trends suggest that with appropriate implementation, mobile technologies are poised to significantly impact the education of billions of people.

Of course, mobile learning is not without its challenges, some of which are unique to mobile technology while others apply to ICT and education more generally. Challenges include limited opportunities for teachers to learn how to incorporate mobile technologies into their classroom practices; concerns about privacy and online safety; negative perceptions regarding the use of mobile phones in education by some teachers and parents; and inequity of device ownership, which still exists despite the fact that mobile phones are the most ubiquitous ICT in history. Finally, around the world some national, regional, district and institutional rules strictly prohibit the use of mobile devices in schools. These policies effectively forbid educators from engaging with mobile learning and, as a consequence, thwart potential educational innovations. It should be noted, however, that none of these challenges are insurmountable. Many strategies already exist, or are currently being developed, to maximize the educational benefits of mobile devices while still ensuring equity and safety for all users.

MOBILE LEARNING: A POLICY VACUUM

While mobile learning is not new, only in recent years has it received sustained interest from educators, governments and commercial entities. Billions of people use mobile devices for communication and other tasks, but only a minority use them on a regular basis for education. Currently the entertainment options available on mobile devices far exceed the educational options, and as a result policy-makers are prone to dismiss mobile technology as distracting or even antithetical to education. As this paper and the larger UNESCO Working Paper Series on Mobile Learning make clear, such a view limits educational opportunities by overlooking a host of programmes that rely on mobile technologies to improve teaching and learning. From initiatives that afford learners greater control over their own education to those that facilitate teachers' professional development, mobile devices assist learners and teachers working in diverse settings across the globe.

All of the papers in the UNESCO Working Paper Series on Mobile Learning call on governments to formulate clear policy directives at the national, regional or local levels regarding the integration of mobile technologies in education. While many governments have adopted some form of national ICT in education policy, most of these policies were created in a 'pre-mobile' era and generally fail to address mobile technology or the relatively new phenomenon of mobile learning. The few policies that do refer to mobile devices tend to reference them tangentially or, in some instances, ban them outright. Currently there is a dearth of considered policies to guide the maturation of mobile learning and ensure that new technologies benefit learners and teachers.

In an effort to address this policy vacuum, UNESCO, in partnership with Nokia, will develop a set of guidelines to help policy-makers and educators create environments that enable the safe, affordable and sustainable use of mobile technologies for education. The UNESCO

Policy Guidelines for Mobile Learning, which will be published in 2013, aim to bring balanced and useful perspectives to the policy table by articulating recommendations for creating policy environments conducive to large-scale mobile learning.

This paper, which will inform the forthcoming guidelines, raises key issues and questions that need to be considered when formulating policies related to mobile learning. It draws on the first twelve papers of the UNESCO Working Paper Series on Mobile Learning, which include global reviews of mobile learning initiatives and their policy implications, as well as reviews of how mobile technologies can support teachers and teacher development. This paper seeks to equip policy stakeholders with a better understanding of mobile learning and its contexts. The sections that follow provide UNESCO's working definition of mobile learning and consider how policies related to mobile learning should interface with existing ICT in education policies. A set of guiding principles, which should be adhered to when creating mobile learning policies, is presented. The remainder of the paper identifies and discusses the key issues related to mobile learning, some directly within the sphere of education and others related to it. The main areas of focus are infrastructure, connectivity and technology provision; cost of usage and government funding; teaching, learning, and education planning and management; and inclusive and safe education. Many existing resources related to ICT and education policy, including those published by UNESCO, are helpful and relevant to mobile learning. Where appropriate, this paper draws on and points to those more detailed resources.

In the context of the large-scale education challenges facing many countries, a variety of avenues for advancing EFA and other educational goals deserve to be explored. Mobile technologies have a proven track record of supporting the delivery of accessible, equitable and high-quality education. By fully engaging with mobile learning from a policy perspective, policy-makers can help move mobile learning from the margins of educational planning to the mainstream.

DEFINITION OF MOBILE LEARNING

Mobile technologies are constantly evolving. Today's mobile technology options include a diverse range of devices – from mobile phones and tablet computers to electronic readers (e-readers), portable audio players and handheld gaming consoles – and tomorrow the list will be different. The extreme pace of innovation makes providing an exact definition of mobile technology a daunting proposition, a case of trying to hit a quickly moving target. To avoid the quicksand of semantic precision, UNESCO chooses to embrace a purposefully broad definition. The Organization recognizes simply that mobile devices are digital, easily portable, and can enable or assist any number of tasks including communication, data storage, video and audio recording, global positioning, and more. While UNESCO supports a flexible definition, much of its current work in mobile learning focuses on mobile phones because of their ubiquity in society. Mobile phones have become a part of daily life for billions of people and UNESCO wants to better understand how these increasingly affordable and familiar devices can be used to support education, either alone or in combination with other tools and resources.

A popular definition of mobile learning is education that involves the use of mobile devices to enable learning anytime and anywhere. While this definition captures much of the essence of mobile learning, it requires two important clarifications. Discussions about mobile learning should: 1) focus more on mobility and its unique affordances than on technology per se; and 2) include questions about how mobile devices can support not only learning but also broad educational goals such as effective education administration and information management.

The power to extend educational experiences beyond classrooms and enable non-formal and informal learning is a key attribute of mobile learning and carries enormous potential to make learning more personalized and relevant. However, in this context mobility 'denotes not just physical mobility but the opportunity to overcome physical constraints by having access to people and digital learning resources, regardless of place and time' (Kukulska-Hulme, 2010a). Thus mobile learning can very much happen in the classroom as well.

Finally, mobile learning does not require a ratio of one device per learner or teacher, which is the approach of the current 1:1 computing initiatives in many countries around the world. While a 1:1 ratio is ideal, it is not always possible given limited resources. Successful mobile learning projects run the full gamut of configurations, from 1:1, to one device for a group of learners, to one device per class.

ICT IN EDUCATION POLICIES

TRANSITION TO AN INFORMATION SOCIETY

In recent years the world has witnessed an economic shift from a purely mass production paradigm, in which manufactured products and natural resources are the basis of the global economy, to a knowledge-creation paradigm in which knowledge is increasingly the key productive factor of value. This is the 'information economy' that is supported, in large part, by ICT. On a social level, the same ICT that enables the creation, analysis and sharing of information is used by people to communicate, access government and financial services, download music and play games. In this 'information society' the way people connect with each other and interact with information has changed profoundly. However, while these technological and communication 'changes are reaching the most remote, rural villages in the least developed countries ... education remains, by and large, unchanged' (UNESCO, 2011*b*).

It is in this context that ICT in education policy should be considered. Many governments have already adopted ICT in education policies over the past two decades. For example, in Africa alone 51 out of 54 countries have some form of ICT in education policy in place (Bassi, 2011). Often such policies are 'focused on the technology – hardware, software, networking, content – rather than its relationship to pedagogy, curriculum or assessment. ICT policy that only addresses these issues is not likely to have an impact on schools and most certainly will not transform education' (UNESCO, 2011*b*). In *Transforming Education: The Power of ICT Policies* (UNESCO, 2011*b*) the case is made for deeply holistic ICT in education policies that seek to not only change all the individual components of the education system but to transform the system itself so that education aligns with and supports the emerging economic and social paradigm shift. In this way the core components of education – such as pedagogy, professional development and assessment – need to be re-evaluated in the light of a technology-enabled, information-based world. This transition is underpinned by the recognition of twenty-first century skills, such as critical thinking, online communication, problem solving, collaboration and digital literacies, which are needed by a changing labour market and supported through the effective use of ICT.

MOBILE LEARNING IN RELATION TO EXISTING ICT POLICIES

While mobile technology is certainly the next chapter in the ICT-for-education story, mobile learning represents something fundamentally different from earlier efforts to infuse technology into education. Traditional implementation models, especially electronically supported learning (e-learning) models, were based on an institutional approach of procure-and-distribute. The technology was scarce, expensive and fragile, and in most developing countries only governments and large institutions could afford it. Under these models learners typically spent less than 45 minutes per week in front of a PC in a school computer lab. As a

result, the learning experience was highly regulated and rarely existed outside the context of school.

Standing in stark contrast to this top-down approach to learning with technology is mobile learning, which is largely unregulated, can happen anywhere and at any time, and employs hardware that is far more affordable and thus more easily self-procured and managed than tethered computers. Mobile phones, and increasingly tablet computers, have reached education from the bottom-up; more often than not, learners already use mobile devices in their daily lives. People use the devices outside of school or university to read, take pictures and videos, write, play games and communicate with others. Because of its bottom-up genesis, mobile learning is not simply 'e-learning gone for a walk', but something wholly different. Mobile learning requires re-conceptualizing the potentialities of ICT in education as well as its models for implementation and usage.

Yet, given the prevalence of existing ICT in education policies, is there a need for countries to adopt entirely new policies dedicated to mobile learning? Much work has been invested in developing current policies, including the time and political will required for policies to be ratified. Unless these policies are very outdated it is not necessary to replace the existing policy with a new one. Taking an 'out with the old and in with the new' approach will ultimately undermine the legitimacy of ICT in education as policy-makers and adherents soon tire of keeping up with the latest gadgetry. Policies should be inclusive enough to remain relevant despite the rapid pace of technological advances.

This paper assumes that in a particular country there is an existing ICT in education policy and strategy, or that such a policy is in the planning stages, and that it follows best practice frameworks and recommendations so as to be as effective as possible. Useful references for developing and implementing effective policies and strategies include *Transforming Education: The Power of ICT Policies* (UNESCO, 2011b); the *ICT-in-Education Toolkit for Policy Makers, Planners and Practitioners* (infoDev and Knowledge Enterprise, 2007); and *Transformation-Ready: The strategic application of information and communication technologies in Africa* (Adam et al., 2011). While these documents consider ICT in general, this paper focuses specifically on mobile learning and mobile technologies. Education opportunities and challenges unique to mobile technologies deserve to be explored in detail.

UNESCO believes that directives and policies related to mobile learning should be incorporated into existing ICT in education policies. However, given the need for policies that transform education, the fact that most policies were written in the 'pre-mobile' era, and the fact that mobile learning is in many respects a different kind of ICT, it is essential that policy-makers review existing policies in their entirety and, where necessary, revise them. This paper aims to serve as a useful reference for policy-makers who are reviewing or creating policies to provide an enabling environment in which mobile learning can grow. In such an environment, top-down policy structures should be aligned with the bottom-up context of mobile use, with both mutually supporting and shaping the other.

MOBILE LEARNING POLICIES: GUIDING PRINCIPLES

UNESCO's Working Paper Series on Mobile Learning, which reviews mobile learning policies and practices around the globe, points to a number of guiding principles that should be kept in mind when creating or revising policies related to mobile learning. In particular, it is recommended that policy-makers:

1. *Leverage existing investments*

Policy-makers should take stock of existing ICT investments and approaches, and devise strategies to complement rather than replace the current infrastructure.

2. *Localize policies*

Policy-makers should consider the local contexts of the country or region when creating new policies or adapting existing ones, as strategies that work for one country may not be appropriate in another.

3. *Support open technical standards*

Policy-makers should encourage the use of open, standards-based platforms for mobile learning applications, to increase access and streamline the development process.

4. *Promote intersectoral cooperation and multistakeholder partnerships*

Policy-makers should promote cooperation between different branches of government and encourage partnerships between stakeholders from a variety of sectors and levels.

5. *Establish policies at all levels*

Policy-makers should create or revise mobile learning policies at both the national and local levels, regardless of whether education is decentralized. National policies should provide overarching structure and guidance, while local policies direct implementation in individual districts or institutions.

6. *Review and update existing policies*

Policy-makers should revisit existing policies, particularly at the local level, that may be overly restrictive in regard to the use of mobile technology at schools and universities. National policies may need to be clarified or revised to give better guidance to districts and institutions.

7. *Ensure inclusive education*

Policy-makers should ensure that mobile learning policies promote gender equality and accessibility for learners with disabilities. This effort is essential to meeting EFA goals of providing quality education to all learners worldwide.

Each of these guiding principles is discussed in detail in the sub-sections below. Subsequent sections of the paper highlight key issues that need to be considered when creating an enabling environment for mobile learning.

LEVERAGE EXISTING INVESTMENTS

Significant capital and human resources have been invested in ICT in education: governments and other organizations have established computer laboratories in schools or community centres, built expensive ICT infrastructure, designed digital content and trained teachers to use ICT for instructional purposes. Wherever possible these investments should be capitalized upon and not discarded. An example is the large-scale 1:1 computing initiatives in Latin America. In 2010 there were at least seventeen countries in the region with 1:1 programmes, with aims to deliver a total of 7.5 million netbooks to learners by 2012 (Severín and Capota, 2011; IIEP-UNESCO, 2012). While these figures indicate that ICT is firmly established on the policy agenda in these countries, the intense focus on the 1:1 roll-out of netbooks has led to a somewhat one-dimensional view of ICT implementation. In many Latin American countries, educational ICT is synonymous only with netbooks and not the wider spectrum of ICT, which includes mobile phones. Yet mobile learning can build on prior investments, including the large-scale procurement of netbooks, the training of technical personnel and the development of digital content. Rather than replacing netbooks, mobile phones can be used to supplement the netbooks' existing functionalities. For example, through mobile data networks, mobile phones can sometimes access the internet when netbooks cannot. They can also facilitate quick and inexpensive communication via Short Message Service (SMS, or text messaging), and can be used in the field for data gathering as well as voice, image and audio recording. All of this data can later be transferred to netbooks for further editing or uploading.

In Europe, nearly all of the successful mobile learning initiatives reviewed by UNESCO used mobile devices in conjunction with other ICTs, such as desktop PCs (Hylén, 2012). Advocates of mobile learning emphasize that mobile technologies are not intended to replace educational interactions or learning experiences but rather complement and enrich them (SIIA, 2010). When it comes to ICT in education the choice is not 'either or' but 'both and'. Wherever possible, programmes should use a range of ICTs, each for what it does best. Of course, because resources are limited, choices must be made about which ICT to invest in. It is important, though, not to focus on one ICT to the detriment of others.

LOCALIZE POLICIES

While much has been said about the need to adapt policies and strategies to the context of a particular country, this maxim is particularly applicable to mobile learning. The widely cited statistic that there are nearly 6 billion mobile phone subscriptions in the world, for example, glosses over what is in reality an uneven and inequitable landscape. To be clear, not all people have mobile phones and far fewer have access to smartphones and mobile broadband. Across and within countries, inequalities exist in the types of handsets available, the purchasing power and literacy levels of users, and access to electricity and mobile infrastructure. Because different circumstances require different mobile learning solutions, it is essential to consider the local context, and the opportunities and challenges that it provides, when developing any mobile learning policy. While many mobile solutions and services can and should be transplanted to different countries, care should always be taken to customize them, where appropriate, for the specific conditions of the country or region. For example, in

an area with strong mobile data infrastructure, affordable data charges and internet-enabled handsets, access to online resources provides a significant opportunity for mobile learning. In other countries, voice, SMS and even Bluetooth solutions, which require no connectivity to a mobile network, may be more appropriate. These simpler solutions can be just as powerful in terms of communication and administrative support as smartphone- or tablet-based strategies.

Given the differences in ICT adoption levels and the maturity of ICT policies – for example, Singapore is currently on its third Master Plan for ICT in Education, while other countries are still in the drafting stage – it may be useful for policy-makers to locate their country on a continuum of ICT in education maturity as they incorporate mobile learning into policies. By examining the steps involved in ICT integration, country representatives can better plan how to move to more advanced stages and maximize the educational potentials of different technologies, including mobile devices. Several publications list categories of ICT engagement to help policy-makers make incremental improvements, including UNESCO's three categories of mobile learning engagement (So, 2012) and the four basic e-maturity levels described in *Transformation-Ready: The strategic application of information and communication technologies in Africa* (Adam et al., 2011).

It is important to note that the local context can be transformed through decisive actions that address the issues highlighted in this paper. Many mobile-related inequalities are the result of influencing factors, such as legacy regulations and a lack of industry competition, both of which can be changed. The intention of this paper is to inform sound policy that can shape the future and, if necessary, overcome past constraints. Also, because the technological landscape changes almost by the month, flexibility is paramount. The kind of features currently associated with the most cutting-edge devices will likely be available in the least expensive ones by the end of the decade. Thus, while local context needs to be considered – especially for short-term solutions – policy should be set with mid- to long-term solutions in mind.

SUPPORT OPEN TECHNICAL STANDARDS

The mobile technology landscape, as with many ICTs, is fragmented. Fierce competition between major device manufacturers and software companies, and a fast pace of innovation, mean that literally thousands of different models exist, running a number of different operating systems, with browsers that support different file formats and web features such as Flash or JavaScript, displayed on different screens of various sizes and resolution capabilities. The challenge of developing mobile learning applications, services and content for such a wide variety of platform configurations presents a barrier to the growth of mobile learning. Developing applications for standards-based platforms, as long as these are open, significantly simplifies the process. For example, Oxford University in the United Kingdom has developed an open-source mobile portal called Molly, which enables mobile applications to work on a broad range of devices, including both standard mobile phones and smartphones (Dykes and Knight, 2012). The web-based application framework detects the device being used and tailors the page to match the phone's capabilities, thus greatly increasing the number of potential users who are able to access the application. Wherever possible, policies should insist that educational applications and platforms support all existing technical standards,

and/or promote the development of new universal standards for hardware, device configurations, communication protocols, file formats and more.

PROMOTE INTERSECTORAL COOPERATION AND MULTISTAKEHOLDER PARTNERSHIPS

All ICT in education policies and strategies are located within a set of national policies, laws, and regulations that influence, and ideally support, the integration of ICT into education systems. A clear ICT in education policy is an enabling but insufficient condition for effective integration of ICT in education. Policies in other sectors are also required to create an environment conducive to the successful implementation of ICT in education (Adam et al., 2011). This is especially true for mobile learning, given the cross-cutting nature of mobile technologies and usage. Coordination is necessary between government agencies for education, trade, telecommunications and ICT, finance, and gender equality, just to name a few. For example, engagement with the Ministry of Finance can lead to amendments to tax laws that result in lower costs of mobile devices and usage, without jeopardizing revenue for commercial stakeholders in the mobile value chain. Collaboration with the Ministry for Women's Affairs or Gender Equality can lead to increased awareness among decision-makers regarding the importance of promoting women's and girls' access to ICT, with particular attention to mobile learning.

In addition to partnerships within the government, cooperation between the public and private sectors is a key factor in the success of any mobile learning programme. Globally, the most successful programmes tend to be those in which a range of stakeholders – including the government, private companies, and academic and non-profit organizations – collaborate to plan and implement projects. The Mobile Mathematics (MoMath) project in South Africa, which supports mathematics learning for high school students by delivering content, quizzes and community messaging via mobile phones, is an example of the diverse partner ecosystem required for successful mobile learning initiatives (Isaacs, 2012*b*; Nokia, 2011). MoMath receives official support from the South African Department of Education (DoE) both nationally and provincially and is bolstered by active involvement from a wide variety of stakeholders, including DoE district officials, a local non-governmental organization (NGO), Nokia, three major mobile network operators, a mobile instant messaging platform and a textbook publisher. In addition, the project enjoys avid participation from teachers, learners and school management in all the schools where it is based. Since its inception in 2007, the MoMath project has achieved significant results in terms of educational outcomes as well as scalability and sustainability. Much of this success is attributed to the high level of cooperation between multiple stakeholders at the national, regional, district and institutional levels.

While partnerships are important in the multifaceted mobile learning ecosystem, they should be structured in a way that does not result in unsustainable pilot projects. In order to grow, the mobile learning field needs genuine, long-term partnerships that support sustainable programmes. Project plans and partners should thus include long-term budgets for investment and maintenance costs. Only partnerships that balance the interests of all parties are viable in

the long-term. It goes without saying that any procurement that is part of or in addition to partnerships should be open, public and transparent.

ESTABLISH POLICIES AT ALL LEVELS

Most education systems are hierarchical in structure, typically with national, regional, district and institutional levels. In different education systems, control, decision-making and implementation of policies are based at different levels. In England, UK, control over decision-making and budgets related to technology in schools was devolved from the national government to local institutions in 2010. Individual schools are now responsible for selecting and procuring ICT that is funded out of their own budgets. In countries with decentralized management, where authority for technology in education usage lies at the district or institutional levels, champion teachers and district officials have often been able to build mobile learning programmes from the ground up. It could be argued, as the UK government has, that decisions regarding mobile learning and other ICT should be handled by local officials, not national policy-makers.

However, even in a highly decentralized education system, policies at both levels are needed. At the national level it is necessary to provide direction and overarching structure to mobile learning and to ensure enabling regulatory and policy frameworks. At the local and institutional levels it is important to guide the implementation of higher-level directives. At both the national and local levels, policies and leadership can dramatically impact mobile learning, whether as catalysts or hindrances (Fritschi and Wolf, 2012*b*). Also, in instances where mobile learning policies exist, these policies deserve to be regularly updated due to rapidly changing technologies and the pedagogical possibilities associated with them.

REVIEW AND UPDATE EXISTING POLICIES

Although mobile learning policies are typically absent at the national level, a number of policies have emerged at the local and regional levels. Local policies often determine how learners are allowed to use mobile technologies on school or university grounds. These rules are commonly organized under the heading of Acceptable Use Policies (AUPs). The AUPs of many institutions strictly prohibit the use of mobile devices on campuses or in classrooms. However, given that mobile technologies play an increasingly central role in the daily lives of people around the world, it seems unlikely that institutions will be able to sustain this approach (Kukulska-Hulme, 2010*b*). Many district and school AUPs need to be updated to support mobile learning efforts.

For many districts and schools it is challenging to find the balance between trying to ensure that learners are safe online while also enabling them to access resources and content that can further their education (CoSN, 2011). In some cases existing national policies, especially those related to online safety, are broad in scope and unclear with regard to implementation. An example of a poorly understood policy is the Children's Internet Protection Act (CIPA) in the United States, which addresses concerns about access to offensive or harmful content

from school and library computers. While the law speaks to an important concern, it provides insufficient guidance on how to actually implement its provisions. Even though the Federal Communications Commission (FCC) released rules regarding the practice of CIPA in 2001 and updated those rules in 2011, many district administrators remain confused about its proper implementation. Because they are fearful of violating the law, district officials regularly prohibit or severely restrict internet access in schools to err on the side of caution (Fritschi and Wolf, 2012*b*). Given the dynamic nature of mobile technologies and ICT in education, policies that address safety should provide detailed guidance pertaining to implementation.

ENSURE INCLUSIVE EDUCATION

Inclusive education promotes the right of all women and men, girls and boys to a quality education that meets basic learning needs and enriches lives. Focusing particularly on vulnerable and marginalized groups, including women and girls and people with disabilities, inclusive education aims to develop the full potential of every individual (UNESCO, 2009). Mobile learning has already proven valuable to many learners, including marginalized women and girls and learners with disabilities. By promoting gender equality and adherence to accessibility standards for hardware, software, website design and content development, mobile learning policies can vastly extend the benefits of mobile learning to all.

Inclusive education is described in greater detail below; however, it is listed as a guiding principle because of its importance in helping achieve EFA goals. Ensuring that the full potential of mobile learning is accessible to as many learners as possible requires a comprehensive approach and commitment to build on the successes to date.

INFRASTRUCTURE, CONNECTIVITY AND TECHNOLOGY PROVISION

Governments play a key role in developing, funding and regulating ICT infrastructure, as well as promoting internet connectivity. To create a policy environment hospitable to mobile learning, it is important to have strategies in place to manage infrastructure, connectivity and technology provision, especially in the context of seeking equal access opportunities for all. As with any technology initiative, it is also necessary to create a waste management plan for the disposal of old electronic devices. Key issues surrounding each of these topics are discussed in the sections that follow.

INFRASTRUCTURE AND CONNECTIVITY

UNIVERSAL ACCESS

In 2010, Finland, recognizing the value of connectivity, became the first country in the world to make broadband internet access a legal right for all citizens (CNN, 2010). Three years earlier the Minister of Public Enterprises of South Africa, Alec Erwin, announced that ubiquitous, affordable broadband access should no longer be seen as the privilege of a few but a basic right for all citizens of the country (ITWeb, 2007). While the South African government has not acted on this statement in the way that Finland has, the position of both countries is significant and could serve as a model for other governments. Universal access to the internet is fast becoming a basic necessity.

While there are many excellent mobile learning solutions that require no internet connectivity, ideally all schools, universities and educational institutions in a country have fast, continuous and affordable access to the internet, as well as continuous supplies of electricity. In addition, universal internet access should be extended to homes and places of study – for example, libraries. Such connectivity provides uninterrupted access to educational content and resources, and opportunities for collaboration with other institutions, teachers and learners, regardless of the device accessing the network – a desktop computer, tablet or mobile phone.

In the USA many school campuses, equipped with high-speed internet access, are blanketed with wireless connectivity to provide access to learners through Wi-Fi enabled mobile devices (Fritschi and Wolf, 2012*b*). In many developing countries, schools do not typically have such facilities and learners often lack access to Wi-Fi enabled devices. Yet, with the increasing coverage of mobile networks offering third generation (3G) data transmission (and more recently 4G transmission), schools without fixed-line internet access can still, by utilizing mobile networks, provide internet connectivity to teachers and learners. Further, learners who own their own 3G-enabled mobile phones are able to connect online directly (although at

their personal expense if the access cost is not subsidized). Mobile learning offers the possibility of universal access even in areas that lack the infrastructure for fixed-line internet.

NETWORK INFRASTRUCTURE

A strong and scalable network based on clear telecommunications and ICT in education policy directives should be established to support connectivity and enable learning, collaboration and management. The effective management, planning and evaluation of education systems rely on accurate and up-to-date data at the institutional, district, regional and national levels. This information can be managed through an education management information system (EMIS), which supports the collection and storage of data and provides a platform from which data can be processed and analysed. Used appropriately, an EMIS allows insights into the internal and external efficiencies, pedagogical and institutional operations, performance, shortcomings and, more broadly, the needs of education systems. A robust network that connects public educational institutions can support the effective use of an EMIS.

Infrastructure and connectivity plans for mobile learning need to be aligned with a country's national network infrastructure strategies, which generally concern fixed-line and wireless connectivity. From a mobile learning policy perspective, it is important that high-speed fixed-line networks provide a strong foundation for mobile networks, and that 3G and higher data networks are rolled out to cover as much of the population as possible. Efforts to ensure that mobile data infrastructure reaches even rural and remote areas are important for ensuring resource-sharing, data capture and equitable access to information.

CLOUD COMPUTING

A reliable infrastructure of solid fixed-line and mobile networks opens up possibilities for cloud computing. Cloud computing refers to the delivery of computing and data storage services over the internet as opposed to an institution's network. Any connected device, be it a fixed-line computer or a mobile phone, can potentially access the cloud servers, where the main data and computing processing is performed. Google Apps, which offers email and a range of software applications, is a popular cloud-based service. None of the schools, universities, teachers or learners using Google Apps need to maintain servers; they simply need to ensure that they have the devices and the connectivity necessary to access the Google services. Ostensibly these services are free for users, but they rely on advertising for revenue. Cloud computing may hold special potential for developing countries because moving data processing and storage to third-party servers can substantially reduce in-house procurement, hosting and maintenance costs.

TECHNOLOGY PROVISION

Mobile learning programmes generally use one of three models to provide mobile devices to teachers and learners: 1) governments or institutions provide devices to learners directly; 2) teachers and learners bring technology they already own to educational institutions (this strategy is popularly referred to as a BYOT or 'bring your own technology' approach); or 3)

governments and institutions can share provisioning responsibilities with teachers and learners (this is essentially a hybrid of the first two models). Each of these approaches is described below, along with a brief discussion of their advantages and drawbacks.

Policy-makers should select the most appropriate model based on particular educational contexts, including the socio-economic status of the teachers and learners, the existence and reliability of high-speed internet access at educational institutions, and the overall ICT in education policy. If possible Ministries or Departments of Education should leverage bulk purchasing of devices and services to negotiate the lowest prices possible from vendors.

PROVIDED MOBILE DEVICES

Many educational institutions provide mobile devices to all teachers and learners to ensure that they have similar devices and consistent access to mobile learning opportunities. One example is Qualcomm's Wireless Reach initiative, which was established in 2006 and is one of the longest running mobile learning initiatives in the USA. Its Project K-Nect provides smartphones to at-risk learners in North Carolina with low mathematics scores and no internet access at home. The smartphones provide around-the-clock access to content specifically aligned with the school's Algebra 1 lesson plans, and allow the learners to collaborate with each other (Fritschi and Wolf, 2012*b*). Another example comes from Colombia where, in an attempt to reduce the high level of illiteracy, the Ministry of Education, together with the Ministry of ICT and the Organization of Ibero-American States (OEI), plans to provide 250,000 mobile phones to illiterate youth and adults living in underprivileged areas of the country. The phones will include SIM cards loaded with six modules of interactive and self-directed educational content aimed at increasing users' literacy and basic skills (Lugo and Schurmann, 2012).

The advantages of providing devices include equitable access, easier integration into instruction because all teachers or learners are using the same type of device, simpler implementation of content filtering and access control, and streamlined management of the overall ICT solution. This approach is also associated with an improvement in grades: in Project K-Nect the end-of-grade test scores for learners participating in the initiative increased by 30% compared to learners who did not receive phones. The ability to access content outside of school and connect with other learners was cited as the main benefit of the project by participating learners, who otherwise would be doing homework in isolation.

The most significant drawback to this approach is the initial cost of purchasing large numbers of devices, with the possible inclusion of access or data plans for each device, as well as the ongoing cost of device maintenance. These costs are generally too high for individual educational institutions, especially those in developing countries. In the USA, initiatives that purchase devices for learners are often funded by the federal government or rely on the financial backing of a corporation.

BRING YOUR OWN TECHNOLOGY (BYOT)

BYOT programmes seek to take advantage of the increasing numbers of learners who own individual mobile devices. In this approach, which is gaining traction in the USA and Canada

(Quillen, 2011) as well as some European countries, learners bring their own devices, whether these be laptops, tablets or smartphones, and connect to the Wi-Fi network at their school to access resources, create content and collaborate with other learners. A laptop-based BYOT programme is included in Denmark's latest ICT in education strategy, which calls for all learners in public schools to have individual computers and access to wireless internet in classrooms by 2014. This goal can only be achieved if the majority of learners bring their own computer or an equivalent device for use in daily instruction, with schools providing equipment for learners who are unable to purchase their own devices (Hylén, 2012).

Because the BYOT model contrasts with traditional ICT in education approaches, where uniform hardware and software are supplied by the educational institution, BYOT programmes require significant shifts in policies and practices. Institutions or governments considering BYOT should have a clear plan for how they will implement the programme, change policies to create a supportive context, develop new instructional practices and resources, and address issues pertaining to equity (Johnson et al., 2011; Quillen, 2011).

The most obvious advantage of the BYOT approach is the low cost and high speed with which mobile learning programmes can be implemented. The cost of the devices, their maintenance and often the access plans associated with them are covered by the learners. Educational institutions can quickly focus on instructional strategies and professional development rather than on the cost and selection of devices. Money saved on devices and data plans can be used to fund other purchases such as increased broadband, digital content and professional development for teachers. Also, because learners typically know how to operate their own devices, there is less of a burden on the institution to provide technical support. It must be noted, however, that while the maintenance costs for individual devices are reduced in the BYOT approach, the overall maintenance overhead may still increase as the institution's information technology (IT) support personnel need to manage a wide variety of devices on the school or university network.

The biggest concern with any BYOT programme is equity, since not all learners are likely to have access to devices or sufficient data plans to connect online. Additionally there are likely to be disparities in the quality of the devices learners own and the features they offer. Where one learner has a high-end touch-screen tablet computer, another learner might have a mobile phone with clunky navigation controls, poor screen resolution and very limited processing power. To ensure equity, educational institutions must provide devices of comparable quality to learners who need them, and there are different strategies for accomplishing this. For example, Algonquin College in Canada has a Mobile Learning Centre from which learners can borrow high-quality devices (Algonquin College, 2011). In South Africa the MoMath project provides mobile kits, which include phones, to participating schools so they can supply devices to learners who need them.

Currently BYOT implementations appear to be more common at well-resourced institutions than poorer institutions. It remains to be seen whether this model will become popular in developing countries, where ownership of powerful devices is more limited – especially, in some countries, for women and girls. For the most part institutions do not have widespread Wi-Fi coverage or the necessary IT support personnel to manage a wide variety of devices. However, as mobile penetration continues to grow and devices become more flexible and intuitive, the BYOT model is clearly worthy of investigation in developing countries. Indeed, it

is there that it could have the greatest impact, by allowing governments and institutions to quickly implement mobile learning programmes with limited start-up funds.

SHARED EXPENSE PLANS

A third model, followed by some districts, schools and universities, is based on a combined approach in which educational institutions fund part of the cost of a device and the required access plan, while learners or their parents fund the remainder. In most cases reviewed in North America, learners who could not afford to contribute anything towards a device obtained additional financial support (Fritschi and Wolf, 2012*b*). In the USA some programmes provide internet connectivity to the homes of learners who do not have it, and increasingly private sector companies offer reduced home access rates for learners with institutionally subsidized devices. Government programmes to subsidize the cost of connectivity should be considered and explored. This approach is discussed in more detail in the Costs and Funding section of this paper.

E-WASTE

The unprecedented uptake of mobile devices has contributed to increasing amounts of electronic waste, or e-waste, caused by discarded devices and accessories. In 2007 it was estimated that a billion mobile phones were purchased that year alone, and that global e-waste – including all electronic devices, not only phones – is growing by 40 million tons per year (Schluep et al., 2009). In Latin America and the Caribbean the accumulation of e-waste could reach critical levels in the near future (Silva, 2009; UNESCO and RELAC, 2010). In most developing countries e-waste is sent to traditional garbage dumps or given to collectors who extract valuable materials from the devices, sometimes in environmentally unsafe ways. These approaches increase environmental damage and local health risks because electronic devices contain materials that are toxic to humans and other organisms. E-waste must be recycled according to standards that are environmentally safe.

It is recommended that governments prepare an appropriate response to e-waste, such as setting up high-tech e-waste management ‘centres of excellence’, which build on existing organizations and informal networks working in the area of recycling and waste management (Schluep et al., 2009). Increasingly governments are including plans to reduce and dispose of e-waste in national ICT policies. The Jamaican government, for instance, devoted a section of its 2011 *ICT Policy* to ‘ICT and the Environment’, with specific attention to the disposal of e-waste (Government of Jamaica, 2011). A number of countries that support the *Plan of Action for the Information and Knowledge Society in Latin America and the Caribbean (eLAC2015)* have committed to formulating public policies that integrate plans regarding ICT use with strategies to manage e-waste (UNECLAC, 2011).

The management of e-waste is an overarching issue that requires its own national policy and legislation. It is important, however, that mobile learning policies recognize and support e-waste efforts by aligning with dedicated policies on the issue.

COSTS AND FUNDING

The cost of usage for mobile devices is an important issue that determines to what extent people can utilize the technology for educational purposes. While Europeans spend just over 1% of their average monthly income on mobile communication, the average African spends 17% (STT and Grosskurth, 2010). The *Futures of Technology in Africa* report, published by the STT Netherlands Study Centre for Technology Trends, notes that despite the very high number of mobile phones in Africa, most of these 'are very cheap or second-hand devices, which hardly ever have usable airtime loaded on them. The primary purpose is to be reachable and not to be able to call others.' The Total Cost of Mobile Ownership (TCMO), which includes the price of the handset as well as connectivity, rental and usage costs, is simply too high in many countries. The result is that people either cannot use mobile devices to their full capacity, or that they spend too much on mobile communications to the detriment of other needs, such as food, health care or education (Heeks, 2008).

From a policy perspective it is necessary to remove the barrier of high cost so that as many people as possible can enjoy the educational benefits of mobile technologies. The lower the cost, the greater the opportunities for teaching, learning and administrative support. Governments should compare their TCMO indicators to other countries with the aim of reducing costs where appropriate. Taxation on mobile devices and usage as well as monopolies in the telecommunications sector are two key reasons for high mobile usage costs. Costs can be lowered by reducing mobile taxes, increasing competition between mobile providers and subsidizing access costs for educational purposes, whether directly or in partnership with mobile network operators (MNOs). Governments can also supply direct funding for mobile learning programmes or provide support to partner organizations, such as universities, to encourage mobile learning research and initiatives. When allocating funding for mobile learning, governments should safeguard project sustainability by considering both the initial purchasing costs and the long-term operational costs, which often outweigh start-up expenses.

TAXATION

Taxation is one of the main reasons for the high price of mobile phones and services. According to the latest Global Mobile Tax Review, taxes that typically apply to mobile telephony are value added tax (VAT) and general sales tax, custom excises and luxury taxes on imported handsets, and 'a host of mobile-specific taxes ranging from airtime excises ... to fixed contributions on connection, handsets, and rental' (Deloitte and GSMA, 2011a). In the 111 countries surveyed in the review, on average these taxes represent 18% of the TCMO. In some countries the figure is much higher, such as in Turkey (48%), Gabon (37%) and Pakistan (31%).

Reducing luxury taxes applied to mobile phones can benefit consumers and be positive for governments as well. For example, Deloitte and GSMA (2011b) noted that when Kenya exempted mobile handsets from value added tax (VAT), mobile penetration rose from 50% to

70% in three years, also leading to higher service tax revenue and more industry jobs. Luxury taxes on mobile phones were conceived at a time when mobile telephony was rare and accessible only to wealthy people. Now that mobile communication is widespread, these tax policies are outdated and stifle the use of mobile technology for education, especially in poor communities. It is critical that governments review their tax treatments of telecommunications goods and services and reduce the costs borne by consumers. This can enable consumers to make full use of basic mobile services – such as voice calls and SMS – and transition to more advanced services such as internet access. While the revision of tax policies is not the domain of education policy-makers, these stakeholders should, where possible, leverage their influence with their respective governments to ultimately ensure that mobile learning opportunities are as affordable as possible.

COMPETITION

According to GSMA and A.T. Kearney (2011), the increasing liberalization of the telecommunications industry and the deregulation of mobile telephony have driven the explosive growth of mobile penetration in Africa and the Middle East, primarily by lowering prices and expanding access. However, many countries around the world still tolerate monopoly control of telecommunication services. When regulatory bodies ensure increased competition between telecommunications providers, the price of connectivity drops. Mobile usage costs have plummeted in a number of African countries, such as Kenya and Namibia, as a result of competition between operators (Calandro, 2011). In Kenya the addition of more MNOs in the market over the last four years has resulted in airtime prices falling by over 70%, leading to a significant increase in usage levels (Deloitte and GSMA, 2011*b*). Where possible, mobile learning advocates should request that telecommunications regulations be reviewed and updated to ensure the lowest possible prices for end-users.

SUBSIDIZED ACCESS

Supporting affordable broadband infrastructure and services for education systems is an important condition for effectively integrating mobile technologies in education. In some instances governments provide full or partial subsidies for broadband access in schools, universities and education centres. In the USA, the FCC plays an important role in education through the School and Libraries programme of the FCC's Universal Service Fund, commonly known as E-rate. E-rate provides US\$2.29 billion in funding to schools and libraries to ensure that learners and teachers have access to fast and affordable internet connectivity and corresponding twenty-first century tools and resources (Fritschi and Wolf, 2012*b*). In South Africa the Electronic Communications Act of 2005 specifies a reduced internet access rate for schools (Government of South Africa, 2006). Schools in South Africa can also apply for support from the Universal Service and Access Fund for the procurement of electronic communication services. Although the implementation of particular aspects of these laws and funding programmes has not always been straightforward, these types of governmental steps are necessary to bring internet access to schools.

Where appropriate, mobile learning policy-makers should consider extending the definition of internet access to encompass not only fixed-line connections but mobile broadband services as well. Government partnerships can be forged with MNOs to encourage or incentivize operators to reduce tariffs for educational use. Providing free or reduced-rate access to educational portals via mobile networks, through a special mobile rate (or 'm-rate') plan or similar subsidy programme, will support mobile learning. Additionally, reduced rates for voice and SMS services will further encourage the development of educational services optimized for mobile technologies.

FUNDING

In Africa and the Middle East, most of the mobile learning projects reviewed by UNESCO were initiated by individuals or organizations that are supported by private corporations or donor agencies; governments have rarely initiated projects that attempt to use mobile phones for educational purposes in or outside of schools (Isaacs, 2012*b*). In Europe, national governments have only extended occasional support for mobile learning. The European Commission, however, has been a major funder of mobile learning initiatives and research (Hylén, 2012). In the early stages of development, research is particularly important because it helps policy-makers and educators better understand the opportunities and challenges related to mobile learning. An example of a successful research initiative was the Mobile Learning Network (MoLeNET) in the UK. Between 2007 and 2010, MoLeNET dedicated 12 million pounds to explore how mobile technologies can best support education. This initiative resulted in a wide variety of projects throughout the UK, many of which were shown to improve learner retention and lower dropout rates. Policy-makers should encourage governments to fund the research and development of mobile learning. This can be accomplished through grants, dedicated agencies or initiatives, or direct support for research or educational institutions.

Long-term funding for mobile learning initiatives and research should support the sustainable growth of mobile learning projects. Currently, far too many projects never move beyond the pilot phase, even when the pilot programmes are successful. One reason for this trend may be that budget plans do not consider the long-term costs for maintaining the programme. Because mobile devices are typically less expensive to purchase than laptops or netbooks, projects that rely on mobile technologies for education often incur lower initial costs than comparable 1:1 laptop programmes. However, for large-scale ICT roll-outs, maintenance constitutes a significant cost – often outweighing initial costs. For example, a survey of netbook projects in developing countries found that the initial costs of projects represented only around one-quarter of the total outlay. Operational costs – for technical support, training, connectivity, electricity, subscriptions and digital content, among other things – accounted for 61% of the total expenditure (Vital Wave Consulting, 2008). When developing mobile learning initiatives, governments should allocate budgets that include the costs of implementing and maintaining programmes, not just start-up expenses.

Funding for mobile learning, including for subsidized access, could potentially come from Universal Service Funds, which are used to finance e-rate programmes in some countries. Worryingly, a GSMA study (2006) of Universal Service Funds found that in 32 countries

surveyed, only 26% of the funds collected had been distributed back to the sector for the development of Universal Access or Universal Service. Such unspent Universal Service Funds could effectively be used to fund the development of education-focused mobile services and help groups that need targeted assistance, such as women and girls or people with disabilities. Where possible, mobile learning policy-makers should urge for unspent Universal Service Funds to be used to support mobile learning efforts in addition to e-rate subsidies.

TEACHING, LEARNING AND EDUCATION PLANNING AND MANAGEMENT

The following components are key to the growth of mobile learning: increased educational content accessible via mobile devices; recognition that mobile learning can occur in a variety of contexts, both in and outside of formal school settings; revised curriculum and assessment modules that reflect the changing nature of education in a mobile-infused world; and professional development and training for teachers to effectively incorporate mobile learning into classroom practice. Also important is the use of mobile technologies to support education planning and management.

CONTENT

A major challenge for mobile learning is the lack of content developed for or accessible via mobile devices (Isaacs, 2012*b*). In order to encourage the further development of mobile learning, policies should push for online content and websites, including national education portals, to be optimized for mobile devices, accessible for free and relevant to local populations.

OPTIMIZE CONTENT FOR MOBILE DEVICES

While the web represents the world's largest repository of educational content, much of this content is created in formats that are not supported by mobile devices. For example, portable document format (PDF) files and documents created in Microsoft Office Suite software such as Microsoft Word or OpenOffice, cannot be opened by most mobile phones in the world, which currently are not smartphones but standard 'feature phones'. While these phones support text messaging, voice calls and other features such as internet access, FM radio, calculator and games, they typically cannot be used to open, edit or create files other than images, videos and sounds.

Most feature phones are equipped with General Packet Radio Service (GPRS), which allows them to browse the web, opening up opportunities to access educational content. However, if websites are not optimized to display on mobile devices, they are awkward to use. Further, many web formats and languages, such as Adobe Flash which is used in animations, are not supported by most feature phones, limiting, in some instances, their suitability for educational support. Some types of content are poorly suited for mobile phones, even powerful and large-screen smartphones. Detailed scientific diagrams or animations, for example, or lengthy textbooks laden with figures and tables, are best accessed via technologies with large displays, such as laptops or tablet computers (and indeed sometimes a physical book is the ideal medium for certain types of content).

Given the dearth of high-quality content available on mobile phones, education policy-makers should advocate that educational materials and websites, where appropriate, be created with mobile access in mind. Making materials available in this medium opens up learning opportunities to huge numbers of people, because most people own or have access to mobile phones. Research from the International Telecommunication Union (ITU) (2011) indicates that twice as many people worldwide access the internet from a mobile device than a tethered computer, further underscoring the importance of making content available on devices like mobile phones. While there are upfront costs involved, much existing content can be retrofitted and tailored to accommodate mobile access. For example, text-only PDF documents can be shared online as HyperText Markup Language (HTML) pages that mobile phone users can access from a basic internet browser. Internet browsing is available on virtually all mobile phones on the market today.

ADAPT NATIONAL EDUCATION PORTALS FOR MOBILE ACCESS

Many countries in the Latin American and Caribbean region, including Argentina, Chile, Colombia and Uruguay, have recently developed high-quality online education portals and a large library of digital content for teachers and learners (Lugo and Schurmann, 2012). Where possible, these sites should be adapted to support access via mobile phones. Educarchile, Chile's national education portal, offers a good example: in 2009, in an effort to increase pass rates for the Prueba de Selección Universitaria (PSU) – the national university admissions test – Educarchile launched PSU Móvil (PSU Mobile), an application that allows users to access the section of the portal dedicated to PSU preparation through their mobile phones. While there is no current data on the number of PSU Móvil users, it is likely that this application has increased access to the portal's test preparation tools. Ideally, policies will incentivize or perhaps require content creators to optimize materials in national education repositories for use on mobile devices. Though it may be costly, this effort is worth the investment because of the reach and ubiquity of mobile technologies.

MAKE CONTENT AVAILABLE TO ALL

Another barrier to accessing educational content online is that the content is often constrained by restrictive licenses or simply too expensive to allow widespread use and reuse in digital mediums. Open educational resources (OERs) provide a commonsense solution to this problem. OERs are educational materials such as textbooks, study guides, research articles and videos that can be freely accessed, reused, modified and shared. They employ copyright licenses such as Creative Commons licenses that encourage people to share and distribute resources. Policies related to mobile learning should support the open licensing of content designed for mobile technologies to ensure it is widely used and adapted. Policies should promote the development of OERs by following recommendations made in UNESCO's recently published *Guidelines for OER in Higher Education* (UNESCO and COL, 2011) and *Policy Guidelines for the Development and Promotion of Open Access* (Swan, 2012). Further, drawing on OER publication models, policies should recommend that governments and educational institutions work with publishers of learning materials to develop business models that will allow more flexible use of educational content on mobile devices (Kukulka-Hulme, 2010b).

DEVELOP LOCALLY RELEVANT CONTENT

Lastly, the creation of educational content in regional, national and local languages, as well as access to mobile devices that display and support composition in local languages, are necessary to guarantee broad access to mobile learning. In addition to language, content should also be relevant to the communities in which learners live, study and work. A UNESCO empirical study on local content showed that there is a strong correlation between the development of communications network infrastructure and the growth of local content in a country (OECD, 2012). This means that simply expanding connectivity is likely to promote the development of content meaningful to local populations. Networks, and the connectivity they enable, lay the necessary foundations for and encourage the development of context-specific content.

LEARNING CONTEXTS

Learning happens in multiple sites – in the classroom, on the playground, in the home, at the work place – and at multiple times throughout the day. Because of their portability, mobile phones can be used wherever learners are, making them well-suited to link formal and informal learning spaces (Looi et al., 2009; Sharples, 2006). For this reason mobile learning projects span a wide spectrum of educational settings. Educators can design tasks and assignments that ask learners to use mobile devices outside of school, and learners can use devices at home that initiate connections to school content or resources. With mobile phones learning also can be situated; that is, it can happen in the actual context of the learning environment as opposed to only in a classroom. This can help make learning more relevant, personalized and flexible in terms of when and where it happens. In this way, mobile learning opens up new pedagogies and ways of learning (Sharples et al., 2007).

To help foster pedagogical innovation in the field of mobile learning, policies should adopt a broad definition of the learning context, recognizing multiple types of learning – including formal, informal and non-formal – as equally valid and valuable. Though interpretations vary, for the purposes of this paper formal learning can be understood as learning that takes place in a formal educational setting, such as a school or university classroom, while informal learning takes place outside of a traditional school setting and is self-directed and often unplanned. Distinct from informal learning, non-formal learning takes place outside of an education or training institution and typically does not lead to certification or qualification, but is structured in terms of learning objectives, time and support.

FORMAL LEARNING

An example of formal learning with mobile devices is the BridgeIT initiative, which has implemented mobile learning projects in a number of countries including Tanzania, the Philippines (Text2Teach), Chile (Puentes Educativos) and Colombia (Raíces de Aprendizaje Móvil). The projects supply teachers with mobile phones through which they can access educational videos to play on televisions in classrooms, along with accompanying lesson plans (UNESCO, 2011*b*; Wilson et al., 2011). By enabling access to previously unavailable

educational content, these mobile learning projects support the improvement of teaching and learning in rural classrooms around the globe.

INFORMAL AND NON-FORMAL LEARNING

In addition to strengthening formal learning opportunities, some mobile learning initiatives aim to better bridge the learning that happens in and outside of schools, by empowering students to engage in informal, self-directed learning outside the traditional classroom setting. The MoMath project in South Africa is such an initiative. Results from the project showed that 82% of mathematics learning – based on curriculum-aligned mathematics teaching in the classroom – took place on learners’ mobile phones outside of school (Isaacs, 2012*b*). Another example of supporting informal learning via mobile devices is the South Korean government’s nationwide plan to adopt digital textbooks by 2015 (Lee, 2011). Policy-makers in South Korea believe that digital textbooks can facilitate self-directed and customizable learning by offering rich content, tools and resources that can be tailored to learners’ abilities and interests. The digital textbooks plan also aims to provide equal educational opportunities to learners who are unable to attend regular lessons in schools due to health- and disability-related issues, as well as learners in rural areas who are often disadvantaged due to a shortage of teachers in certain disciplines and a dearth of media-rich learning resources (So, 2012). It is significant that a national government strategy, albeit the first in the world, recognizes the power of mobile devices to deliver digital content to enable more flexible and personalized learning. Like the curricular resources in the MoMath project, digital textbooks are aligned with formal education and are used both in formal and informal learning contexts.

Mobile devices also support non-formal learning. Non-formal learning differs from informal learning because, while it takes place outside of formal education settings, it is structured by an outside organization or institution, rather than self-directed. An example of non-formal learning that includes the use of mobile phones is the English in Action project, which aims to develop communicative English language skills for 25 million people in Bangladesh by 2017 (English in Action, 2012). BBC Janala, one of the technology components of English in Action, enables learners to easily access English lessons and other educational content via their mobile phones and a website (BBC Janala, 2012). Project leaders for BBC Janala negotiated with local MNOs to ensure that the content can be accessed at an affordable rate. Thanks to these negotiations the cost to access BBC English language services via mobile devices in Bangladesh is only half as much as comparable services (So, 2012).

Other examples of non-formal learning that relies on mobile technology are Samsung SDS Multi-Campus and Nokia Life. Samsung SDS Multi-Campus is an online platform used by more than one million adult learners to develop their career and professional skills (Asia Business Daily, 2011; Samsung SDS, 2011). The main content areas are leadership training, social skills, language and reading, with features for evaluation, tutoring and feedback on progress. Most users access the platform via mobile devices while commuting, effectively turning ‘dead’ time spent on buses and subways into learning opportunities. Nokia Life is an SMS-based information service designed for developing countries that offers a wide range of content channels, with topics that include agriculture, health and education. Learners subscribe to the service to receive the informational SMS messages and pose and answer questions. The service is much less expensive than traditional SMS subscription offerings due to the leveraged purchasing power of the subscribers. In February 2012, Nokia Life had over

50 million subscribers in the four countries where the service is active: India, China, Indonesia and Nigeria (Nokia, 2012).

Mobile technologies, perhaps more so than any other ICT, have a track record of maximizing informal and non-formal learning opportunities. Education policies should thus focus not only on school, college or university education, but also embrace learning that happens outside these formal contexts. The traditional approach is to bring learners to institutions that provide education. Mobile technologies can diversify this model by bringing education to learners wherever they are. This alternative approach does not need to upend learning in schools; it simply helps push education to sites beyond the four walls of the classroom. For the large number of young people and adults who cannot attend formal schooling or training for social, economic or other reasons, using mobile devices to extend the educational experience is greatly advantageous: it opens up new channels for learning without closing existing ones. Policies that acknowledge multiple sites and modes of learning and the importance of non-formal and informal learning can help promote the development and expansion of mobile learning.

CURRICULUM AND ASSESSMENT

The ability to access online resources, create content, participate in online forums and collaborate virtually with others is a hallmark of current ICT-enabled education. These skills and competencies go by various names, including twenty-first century skills and information, ICT, digital or media literacies. Such multiple literacies are needed in an increasingly connected world.

Supporting new forms of learning and acknowledging twenty-first century skills and literacies will require a revisiting of current curricula, learning outcomes and assessments to ensure new skills and literacies are appropriately emphasized and accurately measured. UNESCO's *Media and Information Literacy Curriculum for Teachers* (Wilson et al., 2011) is a helpful resource for the integration of multiple literacies into the formal teacher education system. UNESCO is also working towards Media and Information Literacy Indicators that will help teachers and policy-makers monitor the development of the new competencies – skills, knowledge and attitudes – needed to participate in an information society (Moeller et al., 2011).

MOBILE LITERACIES

Increasingly, twenty-first century skills are developed via mobile technology. Those well-resourced enough to have high-speed connectivity via laptops, tablets or PCs can easily view and comment on YouTube videos, update Wikipedia entries and create photo essays on social media platforms. But for many learners and teachers, high-end devices and high-speed connectivity are either unavailable or out of reach financially. These users access the internet mostly, or even exclusively, from their mobile phones, the majority of which are feature phones. While internet connectivity is possible on these devices, it is usually slow and many websites render poorly on the small, black-and-white screens. Users of feature phones in

developing countries are often hesitant to browse the web because they typically pay per megabyte of data, and websites with images can be expensive to access (the more data downloaded, the more users pay). These users tend to navigate to web pages that are image-light and optimized for use on smaller-screen phones. Still, even with limited access, young women and men around the world are increasingly participating in online communities and creating content via mid- to low-end mobile phones. An example is the Yoza Cellphone Stories project available mainly in South Africa and Kenya (Yoza Cellphone Stories, n.d.; Yoza Project, n.d.). Short mobile novels (m-novels), poems and plays are published on a mobi-site – a website formatted for mobile access – and on a popular mobile instant messaging platform called MXit, for teenagers and young adults to read and comment on. In its first year of operation the stories and poems were read 300,000 times and around 40,000 comments were posted, almost entirely via mobile phones (Yoza Project, 2012).

Most of the comments on Yoza are written in *txtspk*, or mobile short-form language, representing new linguistic styles that challenge traditional notions of literacy competency. For many young people in South Africa, most digital reading and writing happens via mobile phones, and people in developing countries all over the world are using mobile phones to interact online for the first time. Researchers recommend that recognition and attention be given to these emerging ‘mobile literacies’ – which include the language as well as the social interactions on mobile platforms – especially from a curriculum perspective (Walton, 2009). Currently there are very few mechanisms in formal assessment to recognize and assess the twenty-first century skills that are deemed ‘appropriate’, or to seriously engage with those deemed undesirable in traditional views of education, such as *txtspk*. Language and literacy are constantly evolving and the medium of communication deeply influences its meaning. A handwritten note, an email and a text message all demand different tones, styles and degrees of formality which are influenced, at least in part, by the medium, as well as the intended audience and setting. Literacy requires not only knowledge of language but an ability to adapt and modify it to suit a variety of purposes and mediums. Regardless of whether they are acknowledged by formal education systems, mobile literacies exist; it is therefore important to revisit and reassess the literacy and skills needed for everyday life in the twenty-first century, and to update curriculum and assessment to appropriately reflect these new demands.

PROFESSIONAL DEVELOPMENT

Professional development refers to the initial and continuous process of systematically building teachers’ professional skills in accordance with requisite competency standards and frameworks. The professional development of teachers is a cornerstone of ICT in education policy. Older policies focused on developing teachers’ ICT skills, while more recent policies seek to transform education by training teachers to use ICT effectively to achieve educational goals. Approaches include strategies to improve teaching and learning and make administrative tasks more efficient. UNESCO’s *ICT Competency Framework for Teachers* (2011c) offers guidance on specific ICT knowledge and skills required for teachers in today’s diverse teaching environments.

Professional development for mobile learning should, in the long term, be incorporated into ICT in education professional development. However, a number of issues should be noted

and considered in relation to professional development around mobile learning in particular. First, mobile learning in no way suggests that teachers are no longer needed or that learners will be able to master complex concepts in isolation. In an information-abundant society, where the core role of the teacher is no longer 'knowledge transmitter' but more 'learning facilitator', the need to provide guidance to learners on how to access, analyse and critically evaluate information is crucial. From a pedagogical perspective, learning can become trivialized if it is reduced to snippets of information of the type that mobile phones are ideally suited to deliver. Such an approach, without meaningful supports, risks undermining the deep and complex understandings and cognitive skills education is intended to foster (Kukulska-Hulme, 2010b). Teachers are core to the process of advancing understanding and facilitating learning. Furthermore, learners need to be taught digital literacy skills that allow them to navigate the online world effectively, safely and appropriately. UNESCO believes that in twenty-first century education, teachers are more important than ever, as is the professional development that ensures they are qualified to fulfil new and more dynamic roles.

Second, mobile technology is perceived to be disruptive in nature on two levels, one negative and one positive. Many educators are quick to cite the surface-level disruption – for example, learners texting each other in class while they should be listening to the teacher – while failing to recognize the deeper disruption: the potential to fundamentally change teacher-learner relationships and interactions. It is crucial that the perception of disruption is changed from a negative one (where banning appears to be an appropriate response) to one that recognizes the potential of mobile technology to transform education by improving pedagogy and making learning less monolithic. Teachers can leverage the access to information provided by mobile devices and the familiarity that most learners have with new technology to enhance the educational experience they provide. By looking beyond the surface-level disruption it is possible to imagine the positive aspects of mobile learning, even as it calls for sometimes uncomfortable changes in classroom dynamics.

In order to capitalize on the benefits of this kind of 'deep disruption', teachers need to be shown how mobile learning can improve teaching, learning and administration. Teachers should be trained to incorporate mobile devices into classroom pedagogy, teach digital literacy and manage possible disruptive behaviour. It is also important for mobile learning to be portrayed as a viable approach to achieving educational outcomes, not as a new technology fad. For example, at Saddleback Valley Unified School District in the USA, teachers in a mobile learning project participated in extensive professional development that included guidance on how to develop digital content and resources. The teachers worked together to think critically about how to deliver instruction differently using the opportunities afforded by mobile technologies (Fritschi and Wolf, 2012a). The initiative was thus framed as an instruction-focused enterprise and not as a technology project, which allowed the emphasis to remain on students and learning outcomes rather than devices and ICT training. The latest technology should not be used simply because it is available; decisions about how to use mobile devices for education should always be based on what is best for students and teachers in the particular learning context, rather than what the technology can do.

In general there has not been widespread professional development on mobile learning, and mobile devices have rarely been used to deliver professional development and teacher support. Some of the few existing examples are covered in depth in UNESCO's Mobile Learning for Teachers papers (Isaacs, 2012a; Deriquito and Domingo, 2012; Dykes and Knight, 2012; Jara et al., 2012; Fritschi and Wolf, 2012a), which form part of the larger

Working Paper Series on Mobile Learning. In several cases mobile phones have provided an opportunity for teachers to participate in online communities of practice, where they can share resources and experiences with peers and trainers (Fritschi and Wolf, 2012a). In South Africa, for instance, the Teaching Biology Project uses Facebook and SMS to build a community of teachers, many of whom are the only Life Sciences teachers in under-resourced schools and thus isolated from colleagues in the same subject area (Isaacs, 2012a; TBP, 2012). The majority of the teachers access the Facebook page for the group via their mobile phones. A report on project outcomes indicated that teachers responded positively to this mode of communication and peer support, and that mobile technology played an instrumental role in encouraging collaboration between teachers and building teachers' confidence in the use of technology and virtual spaces.

In spite of these successes, examples of mobile learning for professional development and teacher support are extremely limited. There is a significant opportunity to more fully explore how mobile technology can support teachers and contribute to their training, motivation and retention within the teaching profession – urgent requirements for the achievement of EFA goals (UIS, 2011). While some early models of what this might look like in practice are emerging – for example, the ability to reach teachers in remote places, deliver professional development in areas with no or very limited teacher-education institutions, or offer low-cost teacher training – many more are needed.

Mobile learning policies must prioritize the professional development of teachers, because the future success of mobile learning depends on the willingness of teachers to broadly adopt mobile technologies and accompanying practices in and beyond the classroom (Kukulska-Hulme et al., 2011). In many ways mobile learning requires a change in current pedagogy. In an increasingly connected and information-saturated world, teaching must change in order to keep education relevant. Without rethinking pedagogical practice, teachers run the risk of simply doing old things in new ways. Such a shift in teaching practice is a significant undertaking. Institutions providing pre- and in-service training for teachers, such as universities and teacher training institutes, should be encouraged to incorporate mobile learning into their programmes and curricula. Policies should actively promote the development and sharing of best practices for professional development using mobile devices in order to bolster this relatively nascent area of mobile learning.

EDUCATION PLANNING AND MANAGEMENT

ICT can facilitate data gathering and analysis at all levels of education – institutional, district, regional and national – to allow for improved planning and management of education systems. While EMISs are not covered in detail in this document, it is important to include them in ICT policies and strategies. Adam et al. (2011) suggest that policies support 'standardized school-based management information systems and higher education management information systems that are developed using open standards and capable of interfacing with GIS [geographic information systems], social networks, and mobile and low-cost computing.' Mobile devices, because of their ubiquity and reach, have a significant role to play in capturing data for EMISs as well as providing planners and administrators with access to management data. An example is the Mobiles for Supervisors initiative in the

Mendoza province of Argentina, which provided 350 school system supervisors with smartphones and mobile service plans. With these mobile devices, supervisors visiting rural schools – where computers with fixed-line internet connectivity are rare – can connect to the provincial EMIS directly from their smartphones using the mobile network. The supervisors can consult relevant data and enter information related to learners' academic performance and schools' human resources and infrastructure needs. The information entered in the field is then used to supply raw data that is analysed to inform decision-making at the provincial level (Lugo and Schurmann, 2012). Policies related to education management should insist that EMISs support access via mobile devices.

In addition to aiding data collection and information management, mobile technology can also improve communication among education stakeholders. Because mobile communication is instantaneous and inexpensive in comparison to alternatives, it can facilitate more frequent and efficient communication between teachers, parents and learners. Improved communication between educational stakeholders makes for more effective administration of education systems in general. Mobiles can also be used to streamline tasks such as recording attendance and instantly assessing learners' work, giving teachers more time to focus on instruction. Policies should support and encourage the use of mobile technologies to improve classroom efficiencies and strengthen education system management.

INCLUSIVE AND SAFE EDUCATION

It is essential that mobile learning approaches be based on the principles of inclusive education, with a particular eye towards providing educational access for women and girls and people with disabilities. Ensuring learners' safety when using mobile technologies is equally important. Given the sensitivity of these issues and the negative perceptions held by some stakeholders towards the use of mobile devices in education, an active programme of change management and advocacy will be needed to promote the value of mobile learning, emphasize the importance of inclusive education, and address concerns that mobile devices are unsafe and disruptive.

INCLUSIVE MOBILE LEARNING

Mobile learning can and should support inclusive education. In particular, mobile learning policies should include steps to promote gender equality and ensure access for learners with disabilities.

GENDER EQUALITY

While mobile phone ownership is widespread throughout the world, in low- to middle-income countries about 300 million more men than women own mobile devices (GSMA Development Fund and Cherie Blair Foundation for Women, 2010). In these countries a woman is 21% less likely to own a mobile phone than a man. This figure increases to 23% if she lives in sub-Saharan Africa, 24% in the Middle East, and 37% in South Asia. The mobile phone gender gap is a symptom of broader gender inequalities throughout the world. In general, women use ICT less frequently than men, especially in developing countries. This disparity is primarily attributed to low technical literacy among women and cultural barriers which sometimes discourage women from using ICT. Women in many parts of the world are financially dependent on men and do not have control over economic resources, which makes accessing ICT services more difficult, especially when the total cost of device ownership is high. In some societies women are barred from public places, making it difficult for them to access community information centres such as libraries with internet-connected computers (infoDev and PricewaterhouseCoopers India, 2010). The GSMA mWomen Programme (2011) explicitly recommends that policy-makers work to break down unequal cultural barriers and empower women and girls through mobile phone ownership. Women in rural areas and lower income brackets stand to benefit the most from closing the gender gap. Mobile learning holds great potential for reaching marginalized women and girls and providing them with access to lifelong learning.

A number of mobile learning projects specifically target women and girls. An example is the Literacy Promotion through Mobile Phones project in Pakistan, which provides literacy support via mobile phones to adolescent female learners living in rural areas (UNESCO,

2010). Launched in 2009 by a partnership that included UNESCO, Mobilink Pakistan and an NGO called the Bunyad Foundation in Lahore, the pilot project helped 250 participants become literate by reinforcing the skills they developed in a face-to-face class. The project was deemed particularly successful because participants voluntarily contributed around US\$6 to continue the mobile learning programme after the completion of its pilot phase. The initiative has since been expanded to reach 1,250 women and girls living in rural areas of Pakistan (So, 2012).

The 2003 World Summit on the Information Society, attended by delegates from 175 countries, stated in its declaration of principles that ICTs should be used to promote gender equality and women's empowerment in all spheres of society (WSIS, 2003), and UNESCO's EFA goals call for gender equality in education by 2015 (UNESCO, n.d.). Mobile learning provides a genuine opportunity to achieve these goals and extend the benefits of education to women and girls around the world.

In addition to educational benefits, research has found that women, regardless of their age, community or socio-economic status, feel safer and more secure when they own a mobile phone. Women who have mobile phones also enjoy a greater sense of independence and increased economic and professional opportunities (GSMA mWomen, 2011). Mobile learning policies should take into account the specific needs, aspirations and challenges of men and women in order to effectively promote women's empowerment and gender equality, rather than exacerbate existing inequalities. Publications such as the GSMA mWomen Programme's *Policy Recommendations Paper to Address the Mobile Phone Gender Gap* (2011) provide additional suggestions for advancing gender-positive policies.

ACCESSIBILITY FOR LEARNERS WITH DISABILITIES

Mobile learning carries significant potential to extend educational opportunities to learners with disabilities. Mobile technology can deliver flexible and personalized learning experiences that meet the unique and varied needs of disabled learners in ways that traditional education resources and other ICTs cannot. For example, SMS communication, as opposed to audio voice messaging, is easily accessible to hearing impaired users, and assistive programs that read text aloud or enlarge text size on screens are useful to learners with visual impairments. A study of smartphone use at the Royal National Institute of Blind People (RNIB) College in the UK showed that visually impaired learners used mobile phones in their daily lives as much as non-disabled learners (Uffendell et al., 2009). Students from the Institute found that dictation and text-to-speech software was simple to acquire and use, SMS was an effective way to receive College information, and new features and applications for mobiles were surprisingly sophisticated and valuable.

For mobile devices to be useful to people with disabilities, hardware, software and websites need to be designed with accessibility in mind. As the RNIB study showed, mobile phone manufacturers and software developers have made significant progress in accommodating people with disabilities, but there is still work to be done. While features such as dictation, text-to-speech and text magnification are increasingly common in mobile devices, not all mobile phones have these capabilities. In the USA, Section 255 of the Telecommunications Act of 1996 requires that mobile phones and phone services accommodate people with disabilities (United States Access Board, n.d.). By following standards to ensure accessibility

for users with disabilities, phone manufacturers, operating system developers and third-party software developers can enable greater numbers of people to benefit from mobile learning opportunities. Governments should work to ensure that the various companies and organizations in the production chain comply with accessibility requirements.

When designing website content and user interfaces, web designers should follow accessibility standards such as those set out by the World Wide Web Consortium's Web Accessibility Initiative (WAI) (W3C, 2012). The WAI has produced a set of guidelines called the Web Content Accessibility Guidelines 2.0, which provide criteria for creating websites that are accessible to people with different kinds of disabilities (W3C, 2011). Such sites are usually well-formatted for access via mobile phones or devices with low-bandwidth connections. Digital content should also be created with disabled learners in mind. For example, content creators can use the accessibility features built into programs like Microsoft Office to ensure ease of use for people with visual and hearing impairments. The Accessible Digital Office Document (ADOD) Project (2012) offers useful guidelines for creating this type of content.

UNESCO's report entitled *Accessible ICTs and Personalized Learning for Students with Disabilities: A Dialogue among Educators, Industry, Government and Civil Society* recommends, among other things, the development of national and regional policies and school-level ICT plans that promote the use of accessible ICTs to ensure inclusive education for all (UNESCO, 2011a). Mobile learning policy-makers should prioritize the need for these types of policies and refer to the recommendations in the UNESCO report for guidance when drafting them.

SAFE MOBILE LEARNING

Mobile learning policies should include safeguards to protect users' privacy, ensure online safety and prevent inappropriate behaviour associated with the use of mobile devices in education. It is important that safety measures not just shelter learners from online dangers while they are at school but also teach them how to navigate the internet and social media responsibly, both in and outside of educational settings. Finally, while no conclusive evidence points to health risks from mobile phone usage, it is important to acknowledge and continue to research these concerns. These issues are discussed in more detail in the sections that follow.

PRIVACY PROTECTION

As more and more people use networked ICT and interact online, they increasingly – and often unwittingly – share personal information. Websites and mobile applications often track user behaviour and collect user data. Applications used for mobile learning should comply with national privacy laws and generally accepted mobile privacy principles such as those laid out by the GSMA (2012). Measures should be in place to ensure that private and possibly sensitive data collected by educational institutions is kept safe and only be available to those with access rights – for example, the individual learner and his or her teachers. When using a

BYOT approach to mobile learning, protecting users' privacy becomes more challenging, because learners and teachers use their own devices with their own security and privacy settings. As society becomes more connected, privacy and data protection will become an ever more important issue. It is essential that mobile learning policies strike a careful balance between protecting users and invading their privacy.

ONLINE SAFETY AND PROBLEM BEHAVIOUR

Negative social attitudes towards mobile phones are perhaps the biggest barrier to the increased adoption of mobile learning. These attitudes, held by some policy-makers, administrators, teachers and parents, generally stem from a lack of knowledge about the educational uses of phones and an overgeneralized perception that mobile devices are distracting and disruptive. Yet beyond this, mobile phones are often regarded as undesirable or harmful because learners have used them for cheating, cyber-bullying, 'sexting' – sending sexually explicit messages or photographs via SMS – and accessing inappropriate content or dangerous people online. These concerns are not entirely unfounded; according to studies in the USA:

- One-third of teens with mobile phones have admitted to using their phones to cheat, and two-thirds of all teens have reported that others in their school cheat with mobile phones (Common Sense Media, n.d).
- Twenty-six per cent of teens have reported receiving bullying or harassing text messages or phone calls (Lenhart et al., 2010).
- Four per cent of teens have reported sending a sexually suggestive image via text message, and fifteen per cent have reported receiving a text of that nature (Lenhart et al., 2010).

While these statistics are certainly disturbing, it is important to review them in the context of similar behaviour that is happening offline or via other ICT, rather than simply condemning mobile devices as unsafe. Online behaviour usually mirrors offline behaviour in the physical world, and children at risk of abuse in the real world are at risk in the virtual world. Talking about the USA, Dr. Danah Boyd, a leading researcher of youth online behaviour, said:

The most deadly misconception about American youth has been the sexual predator panic. The model we have of the online sexual predator is this lurking man who reaches out on the Internet and grabs a kid. And there is no data that support that. The vast majority of sex crimes against kids involve someone that kid trusts, and it's overwhelmingly family members.' (Paul, 2012)

Bullying, according to Boyd, occurs more frequently in schools than on the internet or via mobile devices, and data show that neither is on the rise. The moral 'panics' over these issues are often influenced by popular media discourses that are emotive and fraught with distortions (Chigona and Chigona, 2008). In short, the extent to which safety risks and problem behaviour are associated with mobile phones is often exaggerated.

That said, the use of mobile devices and other ICTs does pose certain risks, and it is critical that policies are in place to protect learners and teachers. In many countries the safeguarding of learners is a legal responsibility when learners are under a certain age. Safety mandates

include controlling access to potentially harmful content, such as violent, pornographic or age-inappropriate material, and preventing aggressive or predatory communication, such as cyber-bullying and 'grooming' – a term that typically refers to befriending a child online with the intention of committing a sexual offence or otherwise exploiting the child (GSMA mEducation, 2012). Strategies to protect learners include the use of firewalls as well as filtering, monitoring and virus-control software.

Protective policies for online and mobile usage should exist on the national level – such as the USA's federal CIPA regulations – as well as the district or institutional level. For guidance on e-safety, policy-makers can refer to reports such as *Safer Children in a Digital World: The Report of the Byron Review* (DCSF, 2008) and non-profit organizations like Childnet International (2009), Cyberbullying.org (n.d.) and the African Children Cyber Safety Initiative (ACCSI), which was launched in 2009 by the ITU. The mandate of ACCSI is to advance the cause of safe internet culture for African children and youth (ACCSI, n.d.). Actions include an internet awareness campaign targeted at parents and teachers, as well as appeals to African governments to make information security, including children's online protection, a national priority. On a national level, education departments should collaborate with related departments, such as those for human rights and children's rights, when reviewing laws and policies related to online safety.

DIGITAL CITIZENSHIP AND LITERACY

Many education leaders, recognizing that young people are highly likely to access the internet outside of school, believe that schools should teach digital citizenship and digital literacy skills. Students need to learn how to safely interact with people and resources on the internet, and schools are well-placed to provide this type of guidance (Fritschi and Wolf, 2012b). Teaching young people to practice responsible online behaviour provides them an opportunity to develop twenty-first century skills and empowers them to use ICT productively. A three-year study on 'digital natives' in the developing world illustrated how mobile technologies and social media form an integral part of the lives of young women and men, and how in varying contexts they are appropriated to give expression to young people's aspirations for social change (Stumpel, 2011). Participation in social networks and instant messaging platforms encourages social development by allowing young people opportunities to formulate their identities in virtual as well as physical spaces.

Implementing a digital citizenship and literacy curriculum will most likely require policy changes at the institutional level. The role of the school, and parents, shifts from policing mobile phone use and online behaviour to helping learners navigate these technologies responsibly. AUPs should be changed to Responsible Use Policies (RUPs), which are more inclusive than exclusive with regard to the specific kinds of technology allowed at school and the ways in which they can be used. To be useful, policies must be restrictive enough to protect learners but open enough for learners to gain the necessary digital literacy skills that will allow them to navigate mobile and online spaces safely on their own. Given the high-level nature of national policies, the ways in which this balance can be achieved will most likely be articulated in individual classroom practices as well as in regional and institutional policies.

HEALTH CONCERNS

Finally, concerns have been raised about potential health risks associated with the use of mobile technologies, including eye strain from working on small screens and exposure to electromagnetic radiation. To date, most research has concluded that mobile technologies are safe to use (WHO, 2011). However, to be absolutely sure a few governments have adopted precautionary measures including recommendations to limit the use of mobile phones by children. This naturally has implications for mobile learning. The issue of potential health risks from mobile devices is an important one and should continue to be actively researched.

CHANGE MANAGEMENT AND ADVOCACY

As stated above, one of the main barriers to mobile learning is a lack of awareness among politicians and the general public about the educational uses of mobile technologies (Hylén, 2012). This lack of awareness, coupled with negative perceptions of mobile devices by some teachers and parents, means that the case for mobile learning needs to be clearly made. Research showing improved educational outcomes, increased learner motivation, greater potential to extend learning opportunities to unreached or hard-to-reach populations, enhanced efficiencies in education administration, and better communication between teachers and parents reflects only some of the benefits of mobile learning that need to be made visible to stakeholders. The evaluation of mobile learning interventions and the dissemination of best practices – including stories of failure as well as success – are critical to the future of mobile learning.

Increasingly, some teachers and institutions are speaking out for mobile learning and calling for a lift on mobile phone bans in schools. To build on this momentum, education stakeholders – from policy-makers in national government to parents – need to support change management techniques, including targeted awareness-raising, advocacy and knowledge dissemination. A guide written by a group of teachers in North America who have successfully incorporated mobile learning into their classrooms advises teachers who wish to bring mobile learning to their institutions to follow a series of steps that include building relationships with all stakeholders (teachers, learners, parents and guardians, school administrators, and district authorities); providing evidence for the educational value of mobile learning and showing how it aligns with education standards; developing detailed lesson plans for how mobile devices will be used; proposing a pilot programme to test what strategies work best in the local context; obtaining parental permission; establishing use policies and mobile phone etiquette; and setting up appropriate classroom management procedures (Engel et al., 2010).

To maximize such efforts, education stakeholders should ideally share a unified vision of mobile learning. Policy-makers should solicit the opinions of principals, teachers, learners, parents and community members to obtain a balanced view of mobile learning's benefits and challenges. Strong leadership at the national and local levels can help stakeholders reach consensus and clearly articulate their shared vision. Such leadership is often a key component in robust and successful mobile learning programmes (Ally and Palalas, 2011; Greaves et al., 2010; Project Tomorrow, 2010).

Finally, in making the case for the integration of mobile technologies in education, it is important not to oversell mobile learning or its benefits. Mobile learning is not a panacea for the complex and significant challenges faced by global education today. It is one strategy, to be employed in conjunction with existing educational interventions. Change management and advocacy efforts should be rooted in sound evidence and realistic assessments of the contributions mobile learning can make to education.

CONCLUSION

Mobile technology increasingly permeates society and everyday life, and the vast majority of people are likely to own some kind of mobile device in the near future. It is telling that the regions with the lowest mobile penetration, such as Africa, also have the fastest rates of growth (GSMA and A.T. Kearney, 2011). With positive policy action, penetration levels will continue to expand rapidly due to price drops and the availability of increasingly powerful devices for people in developed and developing countries alike. These trends offer significant opportunities for education. While the impact of mobile technologies in areas such as health, government and business is significant, their contributions to formal education have, until now, been fairly minimal. This can and should change. Mobile devices hold a well-established potential to improve education and extend its reach and effectiveness (Deriquito and Domingo, 2012; Dykes and Knight, 2012; Fritschi and Wolf, 2012a–b; Hylén, 2012; Isaacs, 2012a–b; Jara et al., 2012; Lugo and Schurmann, 2012; So, 2012). However, this potential will only be realized through the active participation of a variety of stakeholders.

ICT in education policies provide the necessary framework for effectively integrating technology into education. The unprecedented uptake of mobile devices and the unique opportunities they offer require that existing ICT in education policies be revised to incorporate mobile learning. Some governments and policy-makers are slowly beginning to recognize this need. In Mozambique, for example, the Ministry of Education (2012) has developed a Technological Plan for Education that involves the integration of mobile phones as part of its overall ICT in education strategy. New or revised policies must describe the potential benefits of mobile learning and work to eliminate the barriers preventing its growth.

The guiding principles presented in this paper can assist in the creation of policies that promote the growth of mobile learning and help support EFA goals by extending educational opportunities to greater numbers of people around the globe. Policies should ensure that existing ICT in education investments are leveraged and that mobile learning complements and enriches other approaches to teaching and learning. Policy-makers should carefully consider the local context and telecommunications infrastructure of their country, support open technical standards, engage in intersectoral cooperation, promote partnerships between multiple stakeholders, and establish policies at the local as well as national levels. In addition, policy-makers should review any existing policies related to mobile learning to ensure that local policies are not overly restrictive and national policies provide clear guidance regarding implementation. Lastly, mobile learning policies should seek to promote inclusive education and further efforts to ensure gender equality and accessibility for learners with disabilities.

The key issues discussed in the paper should be considered and investigated in depth. Creating and expanding infrastructure and connectivity options, choosing among different models for technology provision and aligning mobile learning policies with relevant e-waste legislation are just a few of the considerations necessary to advance policies that stretch across various industries and government departments. It is also important that governments reduce the cost of usage by amending tax laws, supporting competition between MNOs or subsidizing access, and that they commit funds and support to mobile learning initiatives, research and development. From an education perspective, policies should require that,

wherever possible, educational content be accessible via mobile devices. Policy-makers should recognize and support formal, informal and non-formal learning and seek to leverage the particular affordances of mobile devices for different learning contexts. Additionally, sound policy should encourage the revision of curriculum and assessment to acknowledge twenty-first century skills and mobile literacies, ensure adequate professional development on mobile learning for teachers, and promote the use of mobile devices to support education planning and management through improved data collection and communication among stakeholders. Finally, when formulating mobile learning policies it is necessary to consider the advocacy efforts that will be needed to raise awareness around mobile learning and address the concerns of different stakeholders. Because safety concerns form a large part of the objections to mobile learning, policies that promote online safety, responsible behaviour and privacy and data protection are integral to the success and growth of mobile learning initiatives.

By adhering to the guiding principles and addressing each component of the mobile learning ecosystem, policy-makers can help ensure that mobile technologies are effectively leveraged to improve educational access, equity and quality, now and in the future.

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Findings from the UNESCO Working Paper Series on Mobile Learning indicate that mobile devices can support Education for All Goals; provide rich educational opportunities in communities of need; supplement and enrich formal schooling; and, in general, make learning more accessible, equitable and flexible for students everywhere.

This paper seeks to help government officials shape policy environments that are conducive to mobile learning. It examines strategies to provide learners cost-effective ways to access to mobile technology as well as methods to ensure that it is used productively both in and outside school classrooms.

The paper is candid about the challenges specific to mobile learning and provides policy-makers straightforward advice on how to navigate issues related to safety, cost and the sustainability of programmes. Dedicated sections examine how policy decisions can encourage the development of mobile content that is relevant to local populations, facilitate the expansion or improvement of mobile infrastructure, and ensure that new technology investments complement existing educational investments.

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. Sound educational policies can help ensure these ubiquitous technologies improve and facilitate learning, particularly in communities where educational opportunities are scarce.

This paper offers an important starting point for policy-makers who would like to take advantage of the unique educational affordances of mobile technologies and open learning opportunities to large numbers of students.

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