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Education for All 2000-2015: achievements and challenges

Evolution and prospects for the use of mobile technologies to improve education access and learning outcomes

Tim Unwin

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Tim Unwin
Secretary General, Commonwealth Telecommunications Organisation, and UNESCO Chair in ICT4D

Abstract
This chapter provides an overview of the evolution of mobile devices and their uses in learning (m-learning), focusing especially on the fifteen-year period of the first Millennium Development Goals. Drawing on this experience, it highlights eight emerging good practices, and six significant policy implications. Four case studies drawn from different parts of the world and at different scales illustrate the considerable success that can be achieved through m-learning. However, the chapter also illustrates that unless very considerable efforts are made to ensure that the poorest and most marginalised people and communities have access to appropriate devices, connectivity and electricity, any increased attention on digital technologies is likely to increase inequalities rather than reduce them.

Evolution and prospects for the use of mobile technologies to improve education access and learning outcomes

‘Mobile’ and ‘Technologies’

This paper focuses specifically on how mobile technologies have been used to improve access to education and enhanced learning outcomes in the context of the Education For All (EFA) and Millennium Development Goals (MDGs). Although there has been considerable enthusiasm for their potential (GSMA, 2011), particularly amongst mobile operators and software application (‘app’) developers, much still needs to be learnt about how they can best be used to contribute to beneficial learning outcomes, especially for the world’s poorest and marginalised (ITU, 2014). The four boxed case studies that accompany this paper provide evidence of successful initiatives from different parts of the world, at varying scales, and from different educational sectors, to highlight the richness and diversity of ongoing initiatives

There are numerous different definitions of m-learning (mobile learning), and it is useful to begin by disentangling some of the complexities that surround this terminology. It is important to emphasise that the inherent notion of ‘mobile’ actually has little specifically to do with technology, and yet it has largely become synonymous with the mobile ‘phone. Wherever, in the past, teachers and pupils have conversed with each other on the move, or a student has read a book while travelling, they have been learning. Learning has always, in some sense, been mobile.

However, the new technologies that have been developed in the first decade of the 21st century, especially those associated with mobile telephony, have liberated the digital-learning, or e-learning, of recent decades from the shackles of fixed Internet connectivity and electricity associated with classrooms and libraries. The term m-learning is thus primarily used to refer to any digital or electronic learning (e-learning) using new information and communication technologies (ICTs) that is in some sense mobile. M-

education is likewise used to refer to education delivered through devices and infrastructure that permit mobility.

Whilst much of the experience gained from the broader field of e-learning is of direct relevance to m-learning (Traxler, 2009), it is nevertheless important to highlight four specific features of mobile devices that mean that they have rather different implications for learning than do traditional ICTs:

- they are generally quite affordable, and are therefore more readily available to a wider range of people than fixed computers;
- they can be used wherever there is wireless technology, be it through mobile cellular networks or wireless local area networks (WLAN) linked to the Internet (Wi-Fi), and can increasingly be used in most parts of the world;
- they are much more personally adaptable than many previous digital devices, such as desktop 'personal' computers (PCs); and
- they are small and generally quite easy to use in terms of their functionality.

These characteristics mean that such devices are much more ubiquitous than many previous ICTs, and proponents of their use for learning have therefore argued that this makes them especially well suited for improving access to education, particularly in poorer countries of the world. Their potential for delivering on the six EFA goals, as well as the MDGs, especially Goals 2 and 3, is therefore something to which careful attention needs to be paid. It may well be that rather than delivering on the MDGs, mobile devices can be used more appropriate to enhance overall quality of learning (EFA Goal 6) and equitable access to appropriate learning and life-skills programmes (EFA Goal 3).

A final initial complexity that needs to be highlighted, is that m-learning does not only refer to learning through the use of mobile 'phones. Although this is indeed the dominant usage of the term, those with commercial interests in tablets, laptops and other small digital devices also insist that their devices should be included in any definition of m-learning. This not only reflects the

increasing importance of the notion of m-learning as an idea, but also the blurring of nomenclature in the field of digital devices. Indeed, many people now use mobile 'phones less for traditional telephony than they do as data sharing devices, cameras, music players, and means of connecting to the Internet. This in turn necessitates careful use of all nomenclature, not least between three different levels of mobile 'phone: basic mobile 'phones that simply provide voice and text facilities; feature 'phones, which are mid-priced, multi-functional devices; and more expensive smart 'phones that also include touchscreens, Wi-Fi, web browsing and are enabled for third-party apps. While some excellent apps have been developed to enable basic 'phones and feature 'phones to use their devices for educational purposes, it still remains the case that high-end smart 'phones provide very much more functionality to those who can afford them than do basic mobile 'phones. The recent reduction in the price of some smart-phone prices to as little as US$25 may well, though, transform the potential of m-learning, if their quality, functionality and ease of use can be guaranteed.

Evolution of mobile technologies and their use in learning

The idea of devices that could combine the powers of computers and telephony was first conceptualised in the early-1970s, with the Dynabook developed by Alan Kay and colleagues in the Xerox Palo Alto Research Centre in California generally being recognised as the first major such concept model (Kay, 1972). Significantly, this included many aspects that lie at the heart of modern m-learning: anytime anywhere; interactive; personal; informal; learning through play; collaborative, and using dynamic simulations (Sharples, 2002). It was not, though, until the early 2000s, with the beginning of the rapid spread of mobile telephony across the world, that the idea of m-learning really began to take off. The history of the MDGs, which were also launched in 2000, is thus closely mirrored by the rapid emergence of mobile telephony in the poorer countries of the world since their origin.

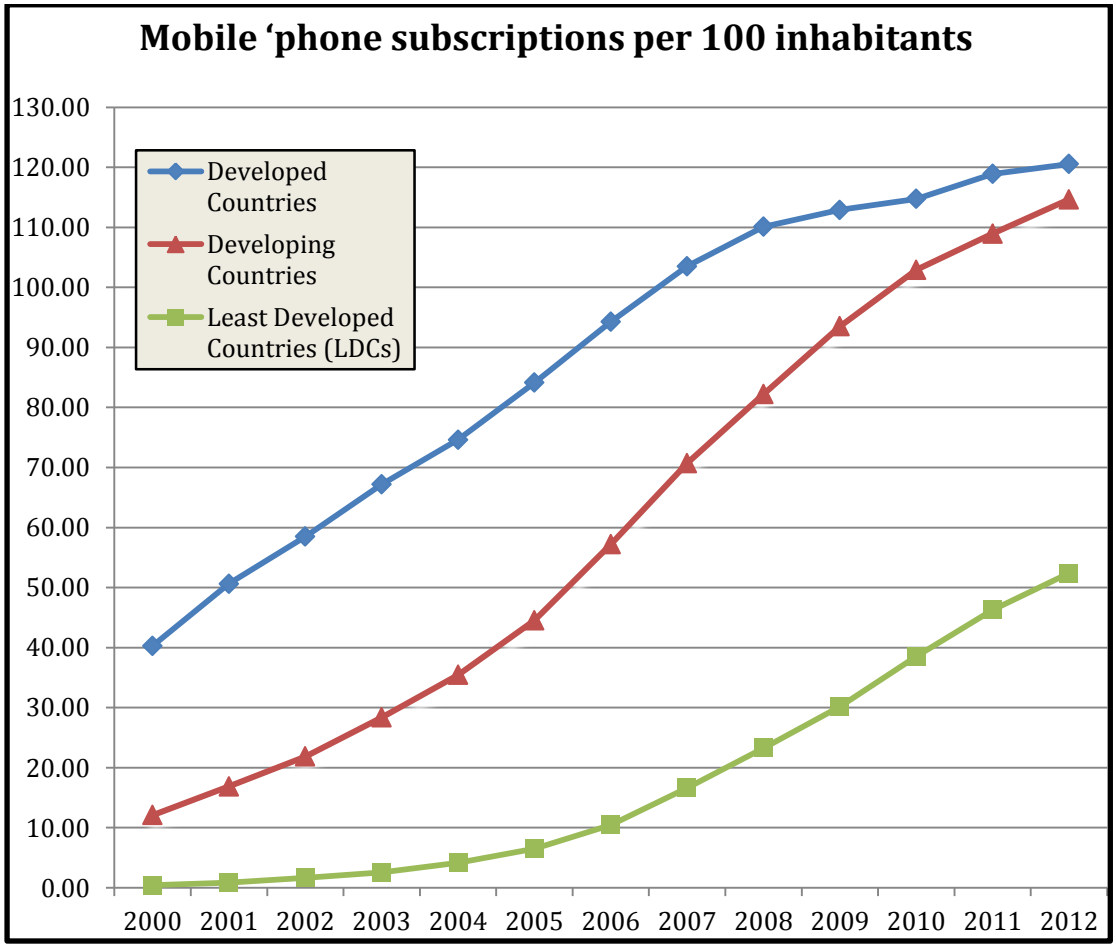
A chronology of mobile technology

Figure 1 highlights the very dramatic expansion of mobile telephony since the launch of the Millennium Development Goals in 2000. At that date, in the

'developed' world there were on average 40 mobile 'phone subscriptions for every 100 people. In 2013, there were 120 such subscriptions. Whilst these data are usually interpreted extremely positively, they also show a darker side, in that the inequality between the richest and the poorest has increased dramatically over the same period. Thus, the gap between the figures for the richest countries and the 'least developed countries' has increased from 40 (40 minus 0) to just under 70 (120 minus 40) subscriptions per 100 people over this 13 year period. Inequality has increased. The rich have been able to gain the benefits, leaving the poorest and most marginalised ever further behind.

Figure 1

Mobile 'phone subscriptions per 100 inhabitants



Source: Rachel Strobel, based on data in ITU (2013)

It should also be emphasised that most of the figures cited in international publications relating to mobile use actually refer, as does Figure 1, to mobile *subscriptions*, rather than actual devices in use, or people who have access to, or use, a mobile device. So, although there were some 6 billion mobile subscriptions across the world at the end of 2011, compared with around 7 billion people, this does not mean that most people had access to and used a 'phone at that date. Detailed research by the GSMA (2012) thus suggests that there were only 3.2 billion unique mobile subscribers (people) in 2012, representing only 45% of the world's population, although other reports suggest that there were some 5.2 billion handsets in use, and 4.3 billion mobile users in 2012 (Ahonen, 2013; mobiThinking, 2013). Broadly speaking, it can nevertheless be concluded that only some half of the world's population currently has, and uses, their own mobile 'phone.

During the period of the EFA goals and MDGs, these figures suggest that mobile devices cannot yet have had a substantial impact on the learning experiences of the world's poorest and most marginalised people. To be sure, the use of smart 'phones has offered huge potential benefits to those who have access to them, but at present this represents but a relatively small percentage, only about a fifth, of the world's population. The other concerning feature of Figure 1 is that the green curve, representing the so-called Least Developed Countries, seems to be beginning to level off, suggesting that its rate of growth is declining. Whilst these curves are for countries, it must also be emphasised that similar distinctions can be drawn between rich urban areas of any one country and the poorer rural areas, and indeed between men and women in many patriarchal societies.

An additional important chronological development has been the evolution of different digital technologies relating to mobile networks during the 15-year period since 2000. This is summarised in Table 1 below, which emphasises that varying technologies have been introduced over different periods during the first decade of the 21st century, although for the sake of simplification it does not include all of them, nor the 2.5G (GPRS) and 2.75G (EDGE) networks. In 2013 it was thus estimated that only some 25% of the world's

population was served by 3G (Third Generation) networks, and could therefore access mobile broadband and the Internet. Hence, once again, there are fundamental structural issues that limit what can be done in different parts of the world. The differences in mobile use between someone using a smart 'phone in an area served by LTE, and someone using a basic 'phone in a 2G network area are immense. This challenge is only likely to increase in the future, as researchers plan for the future of 5G, unless they focus explicitly on ways through which these technologies can become more ubiquitous enabling access for all.

Table 1

Summary of mobile service generations

	1G	**2G**	**3G**	**LTE, HSPA+ or WiMAX (not yet 4G)**
Period introduced	Early-1980s	Early-1990s	1999; early-2000s	2009; early 2010s
Design intent	Basic voice	Voice	Voice with some data (multimedia, Internet)	Primarily data
kbps	2.4	64	384 (mobile) 2,000 (stationary)	100,000
Protocols and standards	Analogue-based	Digital standard (GSM, CDMA), using SMS text messages	First mobile broadband based on packet switching	IP-based (LTE); full mobile broadband

The evolution of m-learning.

Pachler *et al.* (2010) have suggested that there have been three broad phases in the evolution of m-learning: a focus on devices from the mid-1990s; a focus on learning outside the classroom from the early 2000s; and, third, a focus on the mobility of the learner in the latter part of the 2000s. Much of the early work on m-learning took place in richer countries where mobile devices

were first introduced, especially in Europe (Attewell, 2005; Kukulska-Hulme *et al.*, 2009), and it has only been since the mid-2000s that the expansion of mobile telephony has enabled their potential use for learning to be introduced into the poorer countries of the world.

In the earliest stages of m-learning, most interest focused on the potential of mobile devices, initially using the Personal Digital Assistants (PDAs) that were then available, to support teaching and learning within the school environment. However, with the emergence of the new technologies mentioned above in the early 2000s, interest began to shift to the potential of mobile devices to record information and experiences beyond the classroom, and especially on field-trips. Students could take photographs, or record notes on their mobile devices in the field, and then bring these data back into the classroom for subsequent analysis and discussion. This was typified by the European-led MOBIlearn (2002-2006) research and development project involving 24 partners from across the world between 2002 and 2004 that explored context-sensitive approaches to informal, problem-based and workplace learning by using recent advances in mobile technologies. At the same time experiments were undertaken with the use Short Message Service (SMS) messages in two main ways: as a form of "push-learning" where small amounts of information were sent by teachers to students; and also as a means to increase contact and discussion between teachers and students. Building on early experiments such as the BBC's BiteSize initiative, the private sector has increasingly seen the delivery of content through mobile devices to be a considerable market opportunity, and from the late 2000s the delivery of content through mobile devices has expanded considerably in the richer countries of the world.

The potential of m-learning to enable anywhere anytime learning in the mid-2000s also led to some innovative research on ways through which those not in school could gain learning opportunities through mobile devices. Recognising that many out-of-school youth had access to mobile devices, an innovative European Commission funded programme named simply "M-Learning" sought to explore ways through which such devices could be used

to provide them with relevant learning content. As Kukelska-Hulme *et al*. (2009, 6) note, “Reports from the project concluded that mobile learning *can work*, reaching places that other learning cannot, it is best provided as part of a *blend* of learning activities, it offers a *collection of pieces* to be fitted to a learning need rather than a single solution, it is not simply a tool for delivering teaching material but can be used for learning through *creativity*, *collaboration* and *communication*, and that the best way to get started with developing mobile learning is *to try it in practice* through trial and experiment with simple tools”. These are important findings, especially emphasising that m-learning is not a stand-alone solution but rather must be integrated within wider educational transformations if it is to be effective. This message has often been insufficiently heeded by those seeking to implement m-learning initiatives in the poorer countries of the world over the last decade. Significantly, also, the project’s URL (http://www.m-learning.org/) was subsequently taken over by Tribal's Digital Learning Studio, part of the private sector Tribal Group, seeking to embed mobile learning into all areas of education and training. This presents a nice symbolic transition from largely academic research interest in m-learning to its adoption as a key vehicle for generating profit by companies in the private sector.

In the mid-2000s, the field of m-learning had become sufficiently well developed for handbooks for educators to begin to be published (see for example, Kukulska-Hulme and Traxler, 2005). Since then, the use of mobile devices in teaching and learning has diversified considerably, with Pachler *et al*. (2010) recognising three distinct trends: a focus on the mobility of the learner; the design and appropriation of learning spaces; and increased attention to informal and lifelong learning. Many of these directions have taken advantage of the increasingly integrated nature of the technologies associated with mobile devices, and especially their geo-locational attributes. For example, particularly interesting work began to be undertaken around learner-generated contexts, integration with various forms of social media, the use of games for learning, and augmented reality (see also UNESCO-Nokia, 2012). Mobile devices are also becoming actively used for formative and summative assessment purposes, particularly using quizzes as with the Efiko mobile

social quiz platform (http://efiko.com.ng/about.html) that has been developed in Nigeria for secondary school students.

However, as the above examples indicate, much of the development of m-learning has been focused on the use of high-end technologies, that take advantage of the interactivity enabled by smart-phones and connectivity to the Internet. A challenge for those involved in seeking to use mobile-devices in poorer countries where fewer people have such access and connectivity, is to identify how best to take advantage of the potential of m-learning for the majority of young people and learners. Moreover, the disadvantages of mobile 'phones, such as their relatively small screen size and limited memory, must also be taken into consideration when planning their roll-out. The evidence so far adduced suggests that m-learning, as part of a blended pattern of learning, can indeed offer significant benefits for learners and teachers alike, in both formal and informal settings. However, it by no means always has the impact that its advocates anticipate. In recent years, governments in countries as diverse as Kenya, Mauritius and Antigua and Barbuda have embarked on ambitious programmes to issue school-children with tablets or laptops in the expectation that these mobile devices will necessarily be of benefit. All too often, though, the precise objectives of these programmes in terms of quality education nevertheless remains unclear, and so the next section briefly examines the critical importance of identifying success criteria in any m-learning initiatives.

Evaluating success in m-learning

The lack of sufficient effective monitoring and evaluation surveys of the impact and outcomes of e-learning initiatives has already been noted. However, perhaps even more worrying is the fact that the intended outcomes of such initiatives are frequently insufficiently clearly articulated, and without clear goals it is impossible to evaluate whether an initiative has indeed been successful. A recent ITU (2015) report thus emphasises that different participants in m-learning multi-stakeholder initiatives frequently have very different goals; the intentions of governments, teachers and learners, and private sector companies can often be very divergent. The report highlights at

least twelve important criteria of success (Table 2).

Table 2

Interests underlying success criteria of m-learning initiatives

Success criteria	Governments	Private Sector	Civil Society, teachers and learners
Enhanced learning outcomes, differentiated by subjects of study	✓✓	✓	✓✓✓
Value for money with respect to alternative modes of learning	✓		✓✓✓
Scale and number of users	✓	✓✓✓	
Increases in the quantity and quality of learning materials/educational software available for mobile platforms	✓	✓✓✓	✓
Attainment of relevant skills for employment, focusing especially on collaborative learning and assessment	✓✓	✓✓	✓✓
Numbers of devices sold or rolled out to learners	✓✓✓	✓✓✓	✓
Enhanced levels of Internet use, and thus revenue for ISPs and mobile operators		✓✓✓	
Enhanced use of education-based value-added services		✓✓✓	
Enhanced literacy and 1.7numeracy skills	✓✓	✓✓✓	✓✓✓
Increase in employability of learners	✓✓✓	✓✓✓	✓✓✓
Sustainability and funding mechanisms	✓✓	✓✓	✓

Source: Criteria drawn from ITU (2014); number of ticks indicates relative strength of interests as interpreted by this paper's author.

As this list indicates, many of these success criteria actually have rather little to do with the achievement of learning outcomes, or content acquisition, and are often more to do with the potential revenue streams that m-learning can generate for the private sector, be this for content development companies, mobile operators, or Internet Service Providers (ISPs).

The emphasis on devices in the early-2000s noted by Pachler *et al.* (2010), especially in the context of the richer countries of Europe, seems to be particularly pertinent in many poorer countries of the world as 2015 approaches. Thus both governments and the private sector have strong interests in the number of devices rolled out to users. For governments, there is very considerable symbolic and thus political value in providing digital hardware to people; it is a clear physical indicator of modernity, and can act as an inducement to continue to support the party in power at the next elections. For the private sector, any increase in usage of digital technologies is an important source of profit, both in terms of the hardware itself, but also through the longer term potential that this offers for revenue generation through network usage. For the discussion that follows, it is important to note that these two interests are regardless of the actual educational impact that such technologies might have. This is not to say that m-learning does not have important educational potential, but it is to emphasise that in understanding the spread of m-learning initiatives it is very important to recognise the powerful role that the private sector is playing in advocating for m-learning (see for example Ambient Insight, 2011; Gaudry-Perkins and Dawes, 2012; UNESCO and Nokia (2012b). This is particularly well articulated by the GSMA, the body that represents the interests of mobile operators globally, with its landscaping of the m-learning sector (GSMA, 2011) listing the large number of global corporations involved in the field, but it is also prominent in many other publications representing the interest of the private sector (see for example, World Economic Forum Global Agenda

Council on ICT, 2012).

Emerging good practices and policy recommendations

Despite there being insufficient rigorous monitoring and evaluation of the real educational and learning outcomes of m-education and m-learning initiatives, there is increasing consensus amongst practitioners and academics on some of the things that can help to ensure that the use of mobile devices does indeed have a better chance of enhancing education and learning. The four case studies within this chapter provide examples of ways through which such devices can be used effectively in very different contexts, and drawing on these as well as recent overviews (ITU, 2014; UNESCO, 2013; UNESCO and Nokia, 2013; see also Winters, 2013) this section provides a summary of some of the emerging good practices in m-learning, as well as highlighting the most important policy implications.

Emerging Good Practices

There is growing evidence that for m-learning initiatives to be effective they should incorporate eight fundamental elements:

1. *Focussing on learning outcomes not technology*. All too often, e-learning initiatives in general, and m-learning ones in particular, have placed the technology at the forefront; they tend to about how to use the technology, rather than how the technology can be used to deliver educational outcomes. Hence, for mobile devices to be used appropriately for education, it is crucial to begin by identifying exactly what learning outcomes are required, and how mobile devices can contribute. With reference to the current EFA Goals and MDGs, this means that consideration needs to be given first to how mobile devices might contribute to achieving free and compulsory primary education of good quality (EFA Goal 2, and MDG2), and thus how they might be used to deliver learning to the 57 million children who remain out of school (http://www.un.org/millenniumgoals/education.shtml). Second, focus should be placed on ensuring that gender disparity in primary and secondary education is eliminated (EFA Goal 5; MDG3). These are particularly challenging issues in the context of mobile devices not only

because many children of primary school age in the poorer countries of the world do not often have use of mobile devices, and second because the use of mobile ‘phones by women, let alone young women, remains controversial in many patriarchal societies. Given that mobile ‘phones are becoming increasingly ubiquitous, educational solutions are indeed being developed that young children can access through the devices belonging to their parents or an older siblings. Likewise, initiatives can be developed specifically to support girls’ education through mobile devices, but much work still needs to be done to overcome gender inequalities in access to, and use of, mobile devices in certain parts of the world. Mobile devices are therefore most frequently used effectively by older students in secondary and higher education, as well as in the context of lifelong learning, rather than specifically for achieving the existing MDGs.

2. *Involving teachers and users at all stages from design to implementation and review*. This second imperative builds closely on the arguments above. If, for example, primary school children do not often have access to their own mobile devices, enhancement of their learning skills can be achieved through the effective use of such devices by their teachers, not only to develop their own teaching practices, but also to achieve greater content knowledge, and also through educational management and information systems. A key priority for all countries must therefore be the development of effective pre- and in-service training in the appropriate use of all ICTs in the classroom (Unwin, 2005; UNESCO 2011). However, alongside this, experience has shown that where teachers and users are actively engaged in the design and development of m-learning initiatives, the educational outcomes are usually better than when an initiative is simply imposed on them from the outside. This is well illustrated by the focus on teachers and schools in Box 3 on the Learning-on-the-Move project in Singapore. It is important also to emphasise that teachers and students must be involved at all stages of such initiatives, and particularly in monitoring and evaluation processes so that their views can be taken fully into consideration in enhancing the learning outcomes whilst the initiative is ongoing.

3. *Involve participatory approaches in design so as to ensure that adoption of technology is user-centric*. Far too often well-intentioned projects are designed and developed outside the context for which they are actually used. Despite more than a decade of e-learning initiatives in the poorer countries of the world, many ICT for education projects continue to be conceptualised in richer countries and contexts. Additionally, 'second-hand' technologies still continue to be passed-down to people living in poorer contexts, rather than engaging such people actually in the design and development of novel solutions that will really be in their educational interests. Things are beginning to change, but as the earlier sections of this chapter have indicated technological advances in the richer countries of the world are generally outstripping those in the poorer, thereby leading to greater inequality. Efforts to overcome this increasing differentiation, as with the BBC Janala project (Box 1) or FrontlineSMS (http://www.frontlinesms.com) that seek to deliver solutions using basic 'phones, do enable technology-poor communities to benefit from mobile technologies, but much still needs to be done to reduce the inherent inequalities caused through the use of the latest technologies by already advantaged people.
4. *Consider sustainability, maintenance and financing right at the beginning*. Many pilot projects are not initially designed with sufficient attention being paid to sustainability and scale; all too often this is an afterthought. Whilst a government might be able to afford the roll-out of tablets to every child in one year group, for example, it is extremely unusual for them to be able to do this on a regular basis to every year group. The maintenance and financing of e-learning, especially by and for the poorest, most marginal, people and communities is a challenge that has to be addressed head on if m-learning is to be successful. Most m-learning initiatives in poor countries are so new that there has not yet been sufficient time to examine the long-term reliability of the hardware, or the efficiency of the handover of digital devices from one group of completing students to a new generation thereof.
5. *Think holistically and systemically*. Educational transformation is hugely complex, and involves every sector and interest in society. Hence, it is

crucial to be as holistic and systemic as possible in designing m-learning initiatives if they are to be successful.

6. *Ensure that all relevant government departments are involved*. This is closely related to the above point, but emphasises the especial importance that governments have in the educational process. In most countries of the world, education is still recognised as being one of the prime responsibilities of the state. However, many different government departments, and especially education, telecommunications, infrastructure and finance ministries, have a direct interest in the interface between technologies and learning. This was one of the most important findings of the ITU's (2014) m-Powering Development initiative's working groups, which all argued convincingly that a key challenge in implementing such initiatives was the need for many different government ministries to work closely together, not only amongst themselves but also with the numerous other stakeholders involved.. Unfortunately, many government departments tend to function in silos, and for m-learning programmes to be effective it is therefore crucial for an integrated cross-government approach to be adopted, and led by a charismatic senior politician or official, reporting to the highest cross-government body, such as the cabinet of prime minister's office.
7. *Ensure equality of access to all learners, especially those who are marginalised*. The EFA goals and MDGs are fundamentally about ensuring that everyone has access to education, and since their original promulgation there has also been recognition that the education that is provided must also be *quality* education. There is little point simply having children sitting in the classroom if they do not actually learn anything useful. It has already been emphasised that most digital technologies are accelerators, and tend to increase inequality unless specific initiatives are put in place to ensure that everyone can access their benefits. Hence, m-learning initiatives *must* focus primarily on developing technologies and content that can enable everyone to connect to their benefits. This is an enormous challenge, and means that infrastructure, both connectivity and electricity, needs to be universally available, and that the poorest and most-marginalised can indeed have devices that enable them to connect.

Ongoing initiatives such as Facebook's internet.org (http://www.internet.org) and the Alliance for the Affordable Internet (http://a4ai.org/) are seeking to go some way to providing technological solutions, but despite the innovative solutions summarised in the case study boxes that accompany this chapter, much more needs to be done to focus global attention on the educational needs of the poorest and most marginalised, who are by definition the hardest to reach.

8. *Appropriate and rigorous monitoring and evaluation must be in place*. This paper has emphasised throughout that effective monitoring and evaluation, and the sharing of information about good practices is essential for the successful promulgation of m-learning. There is as yet remarkably little good practice in effective monitoring and evaluation of m-learning initiatives, although the UNESCO (2014) report on Worldreader (Box 4) does provide an example of at least one attempt to do so. Much more evidence is nevertheless required about how best m-learning can indeed deliver on the needs of the poorest, and hardest to reach.

Policy implications and strategic imperatives

Building on the above emerging good practices, six important policy implications can be identified for mobile devices to be used effectively in delivering quality education for all. These are relevant not only for governments, but also for all private sector and civil society organisations involved in m-learning. Realistically, m-learning is likely for the foreseeable future to be most relevant to the needs of those who have access to their own devices, and will therefore mostly be used by those above primary school age. Hence, their greatest relevance is not directly focused on MDG2, although initiatives such as Worldreader indicate what can indeed be achieved with young children. There is no doubt that mobile devices have considerable potential for lifelong learning, and have already transformed student learning in many of the richer countries of the world, simply through the access that they provide to the Internet. In the short term, for m-learning to become more effective and mainstreamed, the six most important priorities are:

1. *Joined up approaches across Governments*. Governments should retain the ultimate responsibility for education, and must therefore ensure that they adopt an integrated approach to m-learning as part of their wider ICT and education policies. Two of the simplest things that can be done to make this more effective are for regular strategy implementation meetings to be held by the different government departments involved, and for senior government officials to require regular reporting against practical collaborative delivery.
2. *Sharing of effective and rigorous monitoring and evaluation findings*. This requires not only the implementation of educationally focussed monitoring and evaluation, but also the sharing of findings in a readily understandable mode that is accessible by differing groups of users, including government officials, teachers, learners and companies. International organisations can play a key role to this end by making available details of case studies and examples of effective initiatives.
3. *Ensuring affordability*. A truism that is all too often ignored in rhetoric about m-learning is that it is only available to those who can afford access to a mobile device. The rapid expansion of mobile devices across the world is indeed remarkable, but even the GSMA (2012) recognises that only just over half the world's people are unique mobile subscribers. Intra-family dynamics, whether boys rather than girls are allowed to use a family mobile device, and who actually has access to a tablet given to a child by the government, are all very significant factors in determining the potential delivery of m-learning. Whilst increasing numbers of the world's privileged primary school children do indeed have smart-phones, the learning experiences of the majority of those for whom MDG2 was intended are only likely to be mediated through their teachers' mobile devices.
4. *Providing connectivity*. Enabling any form of digital connectivity in the remotest areas of the world remains a challenge. New technologies are undoubtedly enhancing access, but for the poorest and remotest to benefit equitably from m-learning it is essential for fast high-bandwidth Internet connectivity to be provided in remote rural areas at the same time as in the most exclusive urban enclaves. The realisation that this is currently unrealistic given the present economic and social systems prevailing in

most parts of the world, highlights the enormous challenges that actually remain in enabling effective m-learning for all.

5. *Effective multi-stakeholder partnerships*. On a more positive note, the crafting of truly effective multi-stakeholder partnerships between governments, the private sector and civil society, does offer the potential for innovative solutions to be developed that can help overcome many of the challenges highlighted in this paper. However, implementing effective partnerships is itself challenging, and those engaged in so doing are well advised to draw on the benefits of existing good practices in the field (Geldof *et al.*, 2011; Unwin and Wong, 2012). Far too often stakeholders talk about partnership, but in practice fail to deliver the benefits thereof effectively.
6. *Development of relevant content*. Finally, devices and connectivity have little value for learning without appropriate content. To be sure, access to the Internet alone can indeed provide potential learning opportunities for many people, but without readily available access to localised content in appropriate languages, integrated with a relevant curriculum, and in a format designed for use on mobile devices, the full potential of such devices for learning remains only partially delivered. Hence, considerable concerted effort is required to ensure that such resources are indeed made available to those who need them most, and once again multi-stakeholder partnerships are a valuable mechanism to deliver this. These themes are particularly well illustrated by the BBC Janala initiative in Bangladesh, which has placed considerable emphasis on the importance of high quality content in the local language,

Conclusions

This paper has shown both the benefits of m-learning, particularly through the case studies, but also the very real challenges that remain in seeking to ensure that its potential is indeed made available to those who are in most need of it, namely the world's poorest and most marginalised people. To date, great strides have been made in using the very rapid expansion of mobile devices for the benefit of education, and those companies involved in exploiting this. However, as a review of delivery on the past EFA goals and

MDGs, it is apparent that much remains to be done in using such devices to help achieve universal primary education and gender equality in education.

Looking to the future, as more and more people gain possession of, or access to, mobile devices, they will have the opportunity to use the Internet to access an ever more innovative array of learning tools and content. The challenge, particularly for governments, is how to pay for and use this potential to enable universal access, and thus equality of opportunity within the education sector. Given the central role of teachers and administrators within education, an important concluding recommendation is that much more attention should be paid to providing training, resources and support to them in the use of mobile devices. A well-equipped, knowledgeable and inspired cadre of teachers, capable of using mobile 'phones effectively in their classes, is a crucial first-step towards delivering m-learning for all. Sadly, all too often, even in the richest countries of the world, children are told to switch off their mobile 'phones before entering the classroom. M-learning has much potential, but we are still a long way from using it to benefit the world's poorest and most marginalised.

Box 1

BBC Janala: Bangladesh

BBC Janala in Bangladesh was designed not only to increase the number of people able to communicate in English, but also thereby to enhance the socio-economic opportunities available to citizens of Bangladesh. It is a part of the wider "English in Action" partnership programme (http://www.eiabd.com/eia/index.php/abouts/about-eia), funded by the UK government and running from 2008-2017, that seeks to use many different types of technology, including mobile 'phones, television, the Internet and print materials. In essence, mobile 'phones are used to gain access to content, both in schools and also for adults who want to learn English. As well as the technologies, peer-led English clubs are also encouraged and supported.

The programme is closely aligned with the Bangladesh Government's identification of English language skills as being important for the country's economic development;

English skills have been identified in 2013 as bringing a 22-27% increase in income, and 84% of those aged between 15 and 45 in 2009 indicated a wish to learn English. However, more than a third of people feel that learning English is only available to those who can afford it. Hence, BBC Janala is designed to enable poor people living across the country to gain skills that can enhance their income.

Given its focus on the poor, who generally do not have access to smart-phones, BBC Janala was designed to use feature phones. It also concentrates on speaking and listening to English, because few handsets support Bangla SMS and many of the intended users cannot read the English alphabet. The integration between technologies is a crucial part of its success, with television programmes encouraging learners to use their mobile devices, and those learning from newspapers can also complete a quiz using their mobile 'phones so that they can check their progress. Whilst there is one syllabus (the Amar Engreji Course), this runs across all of the platforms available.

The 2013 BBC Media Action Midline Survey of 6000 representative TV viewers in Bangladesh, supported by a further booster survey of mobile 'phone users led to the conclusion that some 28 million people had engaged with at least one of the learning products since the start of the programme, and that 20% of mobile users had used the service more than 20 times. Significantly, there was strong uptake amongst the poorest 20% of the population.

Six main success factors can be identified from BBC Janala:

1. The involvement of several partners, including all of the six mobile operators and the Regulator to ensure universal access from any mobile 'phone in Bangladesh;
2. A simple memorable shortcode is used to access the service;
3. It is affordable, as a result of operators agreeing that calls should cost only 25% of the normal value-added-service rate, which means that calls cost only BDT 0.5 (US$ 0.006) a minute;
4. There is a strong and simple brand;
5. There is integration and cross-promotion across the different platforms
6. There is high quality and broad content that has been developed to be Bangladesh-specific.

Box 2

Red UnX: a mobile learning community for entrepreneurship in Latin America

This case study highlights three important principles explored in the chapter: the use of m-learning by older students and adults for life-long learning; the importance of partnerships; and the need to integrate mobile-devices with other forms of learning. UnX (http://www.colmenia.org/) is an online community for entrepreneurship that promotes education and collaboration within Spain, Portugal and Latin America. It is co-ordinated by the Center for Virtual Education (CSEV) in collaboration with Telefonica Learning Services, Santander, UNED (National Distance University, Spain), RedEmprendia (a network of universities promoting innovation and entrepreneurship in Latin America) and the Center for Mobile Learning at the Massachusetts Institute of Technology.

In essence, UnX seeks to enhance entrepreneurship skills by using on-line distributed, peer-to-peer learning. Massive Online Open Courses (MOOCs) are used to offer training to large groups, with social media then providing opportunities for peer-to-peer interaction. In the first eight months of the initiative in 2013, there were some 18,000 registered users, 25,300 unique visits to the social networks, with 77% of users being male and 23% female. Most were aged between 20 and 40, with the majority being students and unemployed. Users predominantly accessed the resources in Spain, Brazil, Colombia, Peru and Portugal, and some 12.5% of access was through a mobile device, most frequently an iPad.

In practice, participants enrol on free MOOCs to build their entrepreneurship skills by accessing courses and building up an open community of knowledge through their mutual interactions on social media. These courses are on topics such as "Entrepreneurship and Mobile Application Development with App Inventor", and "Basic Digital Competences in Virtual Education Environments". In order to reduce reliance on academics delivering courses, the UnX platform awards three levels of "Karma" (learner, expert, guru) to indicate social reputation, and thus the reliability of information provided by different users.

Those involved in the initiative (GSMA, 2013) emphasise three particular learnings:

1. Mobile learning is becoming central to flexible, accessible and ubiquitous learning, and is particularly important for lifelong learning;
2. It is important to use both on-line and off-line apps to enrich the learning experience through MOOCs; and
3. The involvement of academics in choosing and defining the apps connected to the MOOCs is critical to the success and quality of their integration into on-line education.

More widely, despite its success, the initiative exemplifies the following key challenges in delivering effective m-learning: the number of men involved is more than three times the number of women; although the technology was designed with the intention of being used by an engineer, a 60-year old or a teenager, the majority of users were nevertheless in their 20s and 30s; and although it is anticipated that by 2015 more than half of users will access the material via mobile ‘phones and tablets, this still highlights the continued importance of non-mobile devices in its roll-out.

Box 3

Learning-on-the-Move in Singapore

The Learning-on-the-Move (LOTM) tool was developed under the Infocomm Development Authority (IDA) of Singapore's *Experimentation@Schools* programme, and highlights the importance of multi-stakeholder partnerships, the engagement of schools, and using the functionality of mobile devices in delivering truly mobile learning. It allows teachers to customise existing interactive heritage trails and design new trails for teaching and learning purposes. Unlike many other initiatives, it places teachers at the heart of m-learning. Two other things have been central to the success of such initiatives in Singapore: first the explicit requirement for such initiatives to involve the private sector (see http://www.ldr.sg/lotm.html); and second the adoption of an integrated approach by different elements of the government.

LOTM has three features that are claimed to be unique:

1. An ability rapidly to create and publish content on a variety of platforms, including both Android and IOS;
2. An ability to fuse content with many geo-locational triggers, such as GPS, image recognition and Bluetooth, thus enabling the full functionality of mobile devices to be incorporated into the learning experience; and
3. An ability to support the live-tracking of participants' locations and performance through the use of a mobile learning management system (LMS).

LOTM was specifically designed to provide learning environments for students to acquire competencies such as critical and inventive thinking, information literacy and communication skills. In practice, as piloted in Clementi Town Secondary School, there were five main usage scenarios:

- Trail objective are entered into the system, and these can include clearly defined learning outcomes;
- The required trail checkpoints can be pre-determined, and learning outcomes identified for each checkpoint;
- An overview map can be created indicating the location of the checkpoints and the desired order through which students should visit them;
- Locations can be selected to trigger the instructions for students to undertake specific activities;

- Teachers can elaborate the specific information, video, quizzes and activities that students need to complete at each checkpoint; and
- Completed trails can then be shared and downloads into mobile devices to run the trail while teachers can track both the location and the results of their students.

One benefit for the learners was that the use of technology as an enabler permitted them to gain added and more realistic, or authentic, experiences that helped them connect what they were learning from textbooks with observations in the real world on the trails. The use of various new technologies such as Voice over Internet Protocol (VoIP) in the form of Skype, and mobile video sharing services in the form of Qik, greatly assisted in the sharing and collaborative creation of knowledge. Students could also gain additional support from the Internet or by communicating with their teachers who could not be present with every group at the same time. Perhaps more controversially, the teachers were able to track and monitor the progress of all of the students in real time. Whilst this clearly has some educational value, it also gives rise to concerns over privacy, and would be difficult to implement in contexts where such close digital monitoring of young people may be less acceptable.

Box 4

Worldreader: making books available to primary school children in low-income countries

Worldreader is a global non-profit, headquartered in San Francisco and with offices in Europe and Africa, working to eradicate illiteracy by delivering a library of e-books to people in low income countries (http://www.worldreader.org). Its intended focus is especially on young children in primary schools, because they assert that if children fall behind, they almost never catch up. The aim is to encourage children to begin reading local stories together with international books that have been curated into a culturally relevant library of books. They argue that their rapid scaling capacity is "the most effective and inexpensive way to eradicate illiteracy globally" (http://www.worldreader.org/what-we-do/).

One important aspect of Worldreader's work has been the amount of monitoring and evaluation that has been undertaken (see for example, UNESCO 2014). For example, (Worldreader, 2013, p.4) in Ghana where each child involved in the iREAD 2 scheme receives an e-reader featuring around 140 titles, 15% of which are textbooks and 85% being age- and grade-related storybooks, the pupils "improved over 50% more on both letter sound knowledge and invented word decoding in English than students in the control schools". Their studies suggest that significant reading improvements are achieved in less than 5 months, and that the use of the e-readers also helps close the gender gap in achievement.

In UNESCO's (2014) wider study of 4,330 users in Ethiopia, Ghana, India, Kenya, Nigeria, Pakistan and Zimbabwe, three main attributes of readers were noted:

- There remains a gender gap in usage, which seems to reflect mobile 'phone ownership, with there being three times as many male users as female;
- Although designed primarily for young children, globally the average survey respondent was 24 years old; and
- Users tended to be more highly educated than national averages, with 24% having an undergraduate degree or above.

Overall, the UNESCO (2014, p.67) study drew seven main conclusions:

1. Mobile reading can open up new pathways to literacy for marginalised groups, particularly women and girls;
2. People use mobile devices to read to children, supporting their literacy acquisition;
3. People seem to enjoy reading and reading more when they use mobile devices;
4. There are clear reasons why people use mobile devices, such as convenience, and these can be promoted to encourage further mobile reading;
5. Although two-thirds of users are under 24 years of age, mobile devices are usable by people of many different ages, and more can be done to encourage older users;
6. Current users tend to have more schooling than is typical, but it is hoped that through using devices in primary schools children will indeed benefit; and
7. There appears to be demand for text in local languages, in level-appropriate text and written by local authors.

Despite considerable enthusiasm for the potential of mobile reading, there nevertheless remain fundamental challenges, not least in terms of cost of hardware and connectivity, in enabling the poorest and most marginalised to access this potential.

References

Ahonen, T.I. (2013) *TomiAhonen Almanac 2013*, http://www.tomiahonen.com/ebook/almanac.html

Ambient Insight (2011) *The worldwide market for mobile learning products and services: 2010-2015 forecast and analysis,* (http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/ambientinsight20102015worldwidemobilelearningmarketforecastexecutiveoverview.pdf)

Attewell, J. (2005) *Mobile Technologies and Lerning: a Technology Update and m-Learning Project Summary*, London: Learning and Skills Development Agency.

Gaudry-Perkins and Dawes, L. (2012) *mLearning: a powerful tool for addressing MDGs*, Alcatel-Lucent.

Geldof, M., Grimshaw, D., Kleine, D. and Unwin, T. (2011) What are the key lessons of ICT4D partnerships for poverty reduction? Systematic Review Report for DFID, London: DFID http://r4d.dfid.gov.uk/PDF/Outputs/SystematicReviews/DFID_ICT_SR_Final_Report_r5.pdf.

GSMA (2011) *Mobile Education Landscape Report*, London: GSMA, http://www.gsma.com/connectedliving/wp-content/uploads/2012/03/landscape110811interactive.pdf

GSMA (2012) Mobile industry to target 1.8 billion 'unconnected' users over next five years, https://gsmaintelligence.com/analysis/2012/10/mobile-industry-to-target-18-billion-unconnected-users-over-next-five-years/355/

GSMA (2013) Red UnX: from a MOOC platform to a mobile learning community for entrepreneurship in Latin America, London: GSMA, http://www.gsma.com/connectedliving/wp-content/uploads/2013/09/cl_me_telefonica_08_13V2.pdf

Guy, R., ed. (2009) *The Evolution of Mobile Teaching and* Learning, Santa Rosa: Informing Science Press.

ITU (2013) *World Telecommunication/ICT Indicators Database 2013*, Geneva: ITU, http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx

ITU (2014) m-*Powering Development Initiative: First Report of the Working Group on m-Learning*, Geneva: ITU BDT.

Kay, A.C. (1972) A personal computer for children of all ages, http://www.mprove.de/diplom/gui/Kay72a.pdf

Kukulska-Hulme, A. and Traxler, J. (2005) *Mobile-Learning: a Handbook for Educators and Trainers*, London: Routledge.

Kukulska-Hulme, A., Sharples, M., Milrad, M., Arnedillo-S´anchez, I. and Vavoula, G. (2009) Innovation in mobile learning: a European perspective, *International Journal of Mobile and Blended Learning*, 1(1), 13–35.

McKinsey & Company and GSMA (2012) *Transforming learning through mEducation* (http://mckinseyonsociety.com/downloads/reports/Education/mEducation_whitepaper_April%201_vFINAL.pdf), Mumbai and London: McKinsey & Company and GSMA

MOBIlearn (2002-2006) Welcome to the MOBIlearn project website, http://www.mobilearn.org

mobiThinking (2013) Global mobile statistics 2013 Part A: Mobile subscribers; handset market share; mobile operators; http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a#subscribers

Pachler, N., Bachmair, B. and Cook, J. (2010) *Mobile Learning: Structures, Agency, Practices*, New York: Springer.

Sharples, M. (2002) Disruptive devices: mobile technology for conversational learning, *International Journal of Continuing Engineering Education and Lifelong Learning*, 12(5/6), 504-520.

Traxler, J. (2009) Learning in a mobile age, *International Journal of Mobile and Blended Learning*, 1(1), 1-12.
(http://unesdoc.unesco.org/images/0021/002176/217638E.pdf)

UNESCO (2011) *UNESCO ICT Competency Framework for Teachers*, Paris: UNESCO.

UNESCO (2013) *Policy Guidelines for Mobile Learning*, Paris: UNESCO (http://unesdoc.unesco.org/images/0021/002196/219641E.pdf)

UNESCO (2014) *Reading in the Mobile Era: a Study of Mobile Reading in Developing Countries*, Paris: UNESCO http://unesdoc.unesco.org/images/0022/002274/227436E.pdf.

UNESCO and Nokia (2012a) *Mobile Learning for Teachers in Europe: Exploring the Potential of Mobile Technologies to Support Teachers and Improve Practice*, Paris: UNESCO

UNESCO and Nokia (2012b) *Mobile Learning and Policies: Key Issues to Consider*, Paris: UNESCO UNESCO and Nokia (2013) *The future of mobile learning: implications for policy makers and planners*, Paris: UNESCO (http://unesdoc.unesco.org/images/0021/002196/219637e.pdf)

Unwin, T. (2005) Towards a framework for the use of ICT in teacher training in Africa, *Open Learning: The Journal of Open and Distance Education*, 20(2), 113-129.

Unwin, T, and Wong, A. (2012) *Global Education Initiative: Retrospective on Partnerships for Education Development 2003-2011*, Geneva: World Economic Forum.

Winters, N. (2013) Mobile learning in the majority world: a critique of the GSMA's position, in: S. Price, C. Jewitt and B. Brown (eds) *The SAGE Handbook of Digital Technology* Research, London: Sage Publications, 402-411.

World Economic Forum Global Agenda Council on ICT (2012) *Accelerating the adoption of mLearning: a call for collective and collaborative action*, Cologny: World Economic Forum (http://www.weforum.org/reports/accelerating-adoption-mlearning-call-collective-and-collaborative-action)