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TURNING ON MOBILE LEARNING IN ASIA

> Illustrative Initiatives and Policy Implications

POLICY FOCUS

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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.

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ABSTRACT

The main purpose of this review is to describe the current state of mobile learning in Asia, and to provide policy-makers, researchers and educators with recommendations for the development of future policies and educational resources that will best support mobile learning in the region.

The paper first reviews the present state of mobile learning in Asia by identifying key characteristics of mobile learning initiatives in the region. Findings from the review indicate that current initiatives aim to: (1) make learning more accessible; (2) promote self-directed learning; and (3) design future learning environments. This section also presents selected case studies to provide concrete examples of the benefits and challenges of implementing mobile learning projects in various educational, cultural and social contexts. Next the paper discusses the findings from a questionnaire study on mobile learning policies to provide information on how governments in Asia view mobile learning from a policy perspective. Experts on mobile learning from eight countries – China, Indonesia, Japan, Malaysia, the Republic of Korea (or South Korea), Singapore, Taiwan and Thailand – completed the questionnaire.

Overall, the review of existing mobile learning projects and findings from the questionnaire study both indicate that very few national-level policies speak specifically to the use of mobile devices for education. While several countries have developed strategic plans to integrate information and communications technology (ICT) into education, these plans do not usually address mobile technologies explicitly, and most mobile learning projects implemented in the region are small-scale and ad hoc. On the whole, this review shows that mobile learning in Asia has yet to move beyond a mostly emerging and experimental stage.

Findings from the study reveal that, while there is tremendous diversity in the region, countries in Asia tend to fall into one of three main categories in terms of their engagement with mobile learning. Countries in Category 1 have a mature mobile market, high penetration of mobile phones and strong ICT infrastructure, and mobile learning is included within the broad context of national-level ICT policies. Countries in Category 2 have a growing mobile market, medium-high penetration of mobile phones and basic ICT infrastructure; mobile phones are used primarily for distance education and informal learning. Countries in Category 3 have an emerging mobile market, low-medium penetration of mobile phones, and weak or basic ICT infrastructure, and mobile learning activities are scarce. Despite some significant activities observed in Categories 1 and 2, no countries in Asia have ICT or education policies in place that specifically address mobile learning, implying that mobile learning is still a relatively new phenomenon and has not yet garnered attention from education policy-makers.

Finally, the paper presents a set of policy considerations drawn from a systemic perspective that involves the micro, meso and macro levels of education systems. It is argued that a vision for future mobile learning in Asia needs to include a macro-level plan for how countries can progress from basic education and knowledge acquisition to learning that emphasizes knowledge deepening and knowledge creation.

BACKGROUND

The last decade witnessed a remarkable leap toward mobile learning across all educational sectors around the world. In the *2011 Horizon Report* on emerging technologies that are likely to have a significant impact on teaching and learning over the next five years, mobile technologies were predicted to have an immediate impact on education globally within one year or less (Johnson et al., 2011). This trend is linked to the widespread proliferation of mobile phones: according to a 2011 report on global ICT trends, 87% of the world's population now has a mobile phone (ITU, 2011*c*).

Because an increasing number of people are using mobile phones in their daily lives, academic researchers and sometimes small groups of teachers, usually working in isolation, have launched disparate projects to explore how these devices might be used to improve teaching and learning in Asia. This review will briefly describe and analyze some of these projects to provide a snapshot of mobile learning in Asia today and predict where it might be heading in the future. After reviewing a number of practical mobile learning projects, the paper will also examine policies related to mobile learning in Asia.

Presently, very few policies, whether regional, national or local, speak directly to mobile learning. In the few instances where mobile learning is mentioned, it is usually buried inside more general ICT or digital learning policy documents. However, because mobile phones are likely to become more relevant to education, it is important to recognize where, if at all, mobile learning fits into the current policy landscape. This report aims to serve as a useful reference for policy-makers endeavouring to revise or design policies capable of creating environments in which mobile learning can mature and thrive.

The paper begins by reviewing the current status of mobile learning in Asia and identifying key characteristics of mobile learning initiatives in the region using illustrative examples. Next, findings from a questionnaire study on mobile learning policies are discussed to provide information on how governments in Asia are currently supporting or inhibiting mobile learning on the policy level. Insights and opinions from experts on mobile learning in eight countries (Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand) are also presented and analyzed. Finally, the paper offers policy recommendations and conceptualizes a vision for the future of mobile learning in Asia.

While mobile learning generally refers to the use of any mobile device in an educational context, for the purposes of this review mobile learning is defined as the use of mobile phones, either alone or in combination with other technological tools, for the purpose of learning. In this paper, Asia refers to the areas of East Asia, Central Asia, South Asia, South-East Asia, Oceania and the Pacific Islands. Because the countries in Asia vary greatly in terms of their infrastructure and educational contexts, it is important to note that the recommendations presented in this review are intended as broad guidelines, which policy-makers and educators will need to tailor to best suit the specific needs of their countries' learners.

METHODOLOGY

Data for this paper were collected in late 2011 and early 2012. An extensive review was conducted to locate relevant reports, documents, research papers and statistical data about mobile learning in Asia, specifically learning facilitated by mobile phones. In addition, a questionnaire study was conducted in October 2011 to examine the current status of national or local policies and initiatives on mobile learning in Asian countries. To recruit potential participants, a purposeful sampling was used that selected people based on the objective of the study. Since the main purpose of the study was to identify the current state of mobile learning in Asia, researchers in higher education settings, who were considered to have expertise and experience in mobile learning research and educational policy, were invited to participate in the study. Thirteen researchers were initially contacted, and a total of eight experts from the following countries completed the questionnaire via an online platform: China, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand. The overall response rate was about 62%.

The questionnaire included a set of questions designed to (a) examine the status of government support for mobile learning; (b) determine the level of mobile learning activities across educational sectors; (c) solicit experts' opinions about the role of key stakeholders, such as the government, researchers, teachers, parents and students, in promoting or inhibiting the use of mobile phones in education; and (d) identify the perceived enablers, barriers and success factors for mobile learning in the region.

For most questions, frequency counts were used to analyze data. For open-ended questions in which the participants shared their opinions, common themes that emerged from qualitative data were analyzed to identify major categories. It is important to note that the small size of the sample may limit the ability to generalize about the findings, and further research on mobile learning policies in each country is necessary. Nonetheless, it is hoped that this initial study provides useful and relevant information for designing public policies on mobile learning in Asia.

MOBILE LEARNING INITIATIVES

As mobile phones become more accessible and affordable, it is important to examine how their features and functionalities might be tailored for educational purposes. This section presents the context for mobile learning in Asia in terms of ICT infrastructure and mobile phone diffusion, and describes the key characteristics of mobile learning initiatives that have been implemented in region. The section closes with a brief discussion of potential issues that may arise when designing or implementing mobile learning initiatives in Asia and elsewhere.

CONTEXT FOR MOBILE LEARNING IN ASIA

The Asian region is diverse in terms of technological and social infrastructure and economic development, and the degree of ICT implementation and integration can vary widely by country. Nevertheless, the region as a whole has made remarkable progress in ICT development in the last decade. According to the Digital Opportunity Index (DOI) that measures progress in ICT infrastructure, opportunity and utilization, eight Asian countries are among the top twenty-five DOI economies: Australia, Hong Kong, Japan, Macao, New Zealand, Singapore, South Korea and Taiwan (ITU, 2007).

Today a majority of people in Asia own and use mobile phones; in 2010, there were nearly 70 mobile phone subscriptions per 100 inhabitants in the region (ITU, 2011*b*). As Table 1 indicates, countries with the lowest number of mobile phone subscriptions are also experiencing the fastest rates of growth. People who do not currently have mobile phone subscriptions are rapidly purchasing them. Assuming a continuation of present trends, it seems likely that mobile phones will soon be ubiquitous in developed as well as developing countries in Asia.

Table 1. Mobile phone subscriptions in Asia

	Number of mobile phone subscriptions per 100 inhabitants			% change per annum
	2000	**2005**	**2010**	**2005–2010**
Macao, China	32.7	110.7	206.4	13.3
Hong Kong, China	80.3	125.5	190.2	8.7
Viet Nam	1.0	11.5	175.3	72.4
Maldives	2.8	69.0	156.5	17.8
Singapore	70.1	102.8	143.7	6.9
Malaysia	21.9	74.9	121.3	10.1
Taiwan, Province of China	81.5	97.6	119.9	4.2
New Zealand	40.0	85.4	114.9	6.1
Brunei Darussalam	29.0	64.1	109.1	11.2
Republic of Korea	58.3	81.5	105.4	5.3
Australia	44.7	90.3	101.0	2.3
Thailand	4.8	46.7	100.8	16.6

	Number of mobile phone subscriptions per 100 inhabitants			% change per annum
	2000	**2005**	**2010**	**2005–2010**
Japan	53.1	76.3	95.4	4.6
Indonesia	1.7	20.6	91.7	34.8
Iran (Islamic Republic of)	1.5	12.2	91.3	49.5
Mongolia	6.4	21.9	91.1	33.0
Philippines	8.3	40.7	85.7	16.1
Sri Lanka	2.3	16.9	83.2	37.6
Lao People's Democratic Republic	0.2	11.4	64.6	41.5
China	6.7	30.1	64.0	16.3
India	0.3	7.9	61.4	50.7
Pakistan	0.2	8.1	59.2	48.9
Cambodia	1.0	8.0	57.7	48.5
Bhutan	0.0	5.5	54.3	58.1
Timor-Leste	–	3.3	53.4	74.5
Bangladesh	0.2	6.4	46.2	48.5
Afghanistan	0.0	4.3	41.4	57.3
Nepal	0.0	0.8	30.7	107.4
Democratic People's Republic of Korea	0.0	0.0	1.8	–
Myanmar	0.0	0.3	1.2	32.8

Source: UNESCAP, 2011

Data suggest that many people in Asia are purchasing mobile phones before or in lieu of personal computers (PCs). Table 2 illustrates that although very few households in countries like Bangladesh, Cambodia and Lao have PCs, they do often have access to a mobile phone. This finding implies that people who could not afford personal computers in the 1990s and 2000s are now foregoing PCs altogether and, instead, purchasing newer mobile technologies; they are, in essence, skipping the 'PC revolution' and embracing the more recent revolution in mobile computing and communication. Given the low purchasing power of people in developing countries like Bangladesh, this trend is not particularly surprising. According to a recent special report in *The Economist* (2011), mobile phones are a more accessible and more affordable tool for communication and learning than PCs.

Table 2. Mobile phone subscriptions and percentage of households with computers in Asia

	Number of mobile phone subscriptions per 100 inhabitants	Percentage of households with a computer
Macao, China	206.4	80.1
Hong Kong, China	190.2	77.3
Viet Nam	175.3	14.2
Maldives	156.5	54.4
Singapore	143.7	84.0
Malaysia	121.3	41.0
New Zealand	114.9	83.9
Brunei Darussalam	109.1	79.6
Republic of Korea	105.4	81.8
Australia	101.0	81.1

	Number of mobile phone subscriptions per 100 inhabitants	Percentage of households with a computer
Thailand	100.8	22.8
Japan	95.4	88.5
Indonesia	91.7	10.8
Iran (Islamic Republic of)	91.3	33.7
Mongolia	91.1	22.3
Philippines	85.7	13.1
Sri Lanka	83.2	12.3
Lao People's Democratic Republic	64.6	6.9
China	64.0	35.4
India	61.4	6.1
Pakistan	59.2	13.0
Cambodia	57.7	4.3
Bhutan	54.3	6.4
Bangladesh	46.2	3.1
Nepal	30.7	4.2

Source: ITU, 2011c

Pricing for mobile phones and related services also emerge as an important factor driving the rapid adoption of mobile phones in low-income countries. ICT Price Basket is an index developed by the International Telecommunication Union (ITU) to provide information about the affordability of ICT services (i.e. fixed telephone, mobile phone, and fixed and mobile broadband internet subscriptions) compared to the average gross national income per capita (ITU, 2011*a*). Recent figures indicate that the prices for mobile phones and internet access have decreased substantially in all regions of the world. Access to ICT has become vastly more affordable in many Asian countries, such as Bangladesh, Bhutan and Sri Lanka, which have seen a dramatic drop in the cost of ICT in recent years. This situation has opened the door for a variety of mobile learning projects throughout the region.

KEY CHARACTERISTICS OF MOBILE LEARNING INITIATIVES

Several recent mobile learning initiatives in Asia have demonstrated the potential of mobile technologies to improve teaching and learning. The following sections highlight some of the key characteristics of mobile learning initiatives in the region, using individual projects as illustrative examples.

MAKING LEARNING MORE ACCESSIBLE

One of the most significant characteristics of mobile learning in Asia is the ability to provide basic education and continuous learning for people living in rural areas. The use of mobile technologies to increase access to education has been well-documented in developed countries. In developing countries, mobile learning holds the potential to make learning more accessible to people who are less reachable through other types of technologies (Islam and

Doyle, 2008; Motlik, 2008). Two forms of education supported by mobile phones are discussed in this section: literacy education and distance education.

LITERACY EDUCATION

Literacy education is an area where the use of mobile learning can have a particularly positive impact, especially for disadvantaged populations. Increasing the literacy rate is an imperative issue in developing countries. As shown in Table 3, several countries in Asia have not yet reached high literacy rates for adults. In particular, the average adult literacy rate in South and South-West Asia is about 65%, which is significantly lower than other regions in Asia. Gender disparity in adult literacy rates is an even more critical problem in some Asian countries, such as India, Nepal and Pakistan, where the female literacy rate is considerably lower than the male literacy rate.

Table 3. Literacy rates in Asia

	Adult literacy rate (% of population aged 15 and above) 2005–2009	Gender parity index for adult literacy rate (Female-to-male ratio) 2005–2009
East and North-East Asia	**94.5**	**0.95**
China	94.0	0.94
Democratic People's Republic of Korea	100.0	1.00
Macao, China	93.5	0.94
Mongolia	97.5	1.01
Republic of Korea	–	–
South-East Asia	**92.4**	**0.95**
Brunei Darussalam	95.3	0.97
Cambodia	77.6	0.83
Indonesia	92.2	0.93
Lao People's Democratic Republic	72.7	0.77
Malaysia	92.5	0.95
Myanmar	92.0	0.94
Philippines	95.4	1.01
Singapore	94.7	0.94
Thailand	93.5	0.96
Timor-Leste	50.6	0.73
Viet Nam	92.8	0.95
South and South-West Asia	**63.7**	**0.71**
Afghanistan	–	–
Bangladesh	55.9	0.84
Bhutan	52.8	0.59
India	62.8	0.68
Iran (Islamic Republic of)	85.0	0.90
Maldives	98.4	1.00
Nepal	59.1	0.65
Pakistan	55.5	0.58
Sri Lanka	90.6	0.97

Source: UNESCAP, 2011

Literacy education focuses on providing educational programmes and resources to illiterate people who want to develop the ability to read and write. One of the emerging concerns in literacy education is how to help people retain their new literacy skills. Kam et al. (2009) argued that a lack of opportunities to use new literacy skills in daily tasks, and a lack of rich media resources (e.g. books, newspapers, etc.) that reinforce new literacy skills are critical problems that need to be addressed in literacy education. Mobile learning has the potential to resolve this issue by providing continuous, affordable and easy access to educational content, resources and applications.

Pakistan is one of the countries in South Asia with low literacy levels, with an average adult literacy rate of 55.5%. Illiteracy is especially pronounced among women: in 2011, only 40% of women over the age of 15 were literate, while 69% of men were (UNESCAP, 2011). In 2009, UNESCO collaborated with the mobile service provider Mobilink and a local non-governmental organization (NGO) to launch a mobile learning project in Pakistan aimed at promoting literacy education for women through mobile phones (UNESCO, 2010). A five-month pilot project was conducted with 250 adolescent girls in rural areas of the Pakistani province of Punjab to examine the impact of literacy education via mobile phones on marginalized women (Miyazawa, 2009). After the completion of a basic literacy course, the participants were each given a mobile phone to receive learning resources via daily text messages from teachers enlisted by the NGO. The students were required to practice handwriting and re-reading the messages in their workbooks, and to respond to their teachers and answer questions through text messages. The cost of the project was approximately US$55.2 per student, which included the cost of a mobile headset ($33), a SIM card ($3), a Short Message Service (SMS, or text messaging) plan ($12), and hiring a teacher ($7.2 per student for 5 months). Participants' literacy gains were evaluated each month. Before the intervention, only 28% of the students scored an 'A' grade in the examination following the basic literacy course. After participating in the programme, more than 60% of the participants received an 'A' grade, which represents a significant improvement from the initial stage. Another indicator of the project's success was the participants' willingness to continue the literacy programme after the pilot project ended. Each participant voluntarily contributed about US$6 to continue the literacy programme with mobile phones. In addition, the women often shared learning resources and information with their family members, which may imply that this type of programme, when successfully implemented, could encourage intergenerational learning, benefitting even non-participating members of the community. The programme also faced some challenges, including difficulties gaining support from local communities and participants' family members in the early stages of the project, and SMS character limitations, which prevented teachers and students from sending longer messages. Nevertheless, the programme has been so successful in its pilot stage that it was recently scaled up to include 1250 girls in other rural areas in Punjab.

India is another country with relatively low literacy levels: the adult literacy rate is 62.8% and the gender disparity index is 0.68. The Mobile and Immersive Learning for Literacy in Emerging Economies (MILLEE) project in India is a research-based initiative that investigates how mobile phones can be used to enhance English language skills (Kam et al., 2009). In particular, this project seeks to reach out to low-income students in rural areas who have had minimal access to traditional education systems. Since 2004, the research team has conducted several mobile learning pilot projects in India to inform the design of larger-scale English as a Second Language (ESL) programmes for children in rural areas. Specifically, the research team has focused on providing educational opportunities for out-of-school learning

through mobile phones. As part of this research, selected students participated in an after-school programme where they learned English using mobile-based games that they played for approximately six hours per week. The games were designed to test the students' comprehension and recall of English words and phrases. Findings revealed that study participants achieved significant learning gains after receiving the mobile-integrated intervention. However, the programme helped students who already possessed robust literacy skills more than students with weaker skills. Kam et al. (2009) suggested that more scaffolding strategies were necessary to better help students in rural areas who have relatively weak academic foundations.

DISTANCE EDUCATION

Distance education or electronic learning (e-learning) in higher education is another area where mobile phones have been used effectively to increase educational opportunities for people living in less developed regions. While Asia has witnessed a substantial increase in the number of students enrolled in tertiary education in recent years, the gross enrolment rate in the region is 22.3%, which is still significantly lower than the rates in Europe (62%), Latin America (36.9%) and North America (81%) (UNESCAP, 2011). Table 4 presents the gross enrolment rates in tertiary education in Asian countries. Overall, it appears that the opportunities for higher education are closely related to a nation's gross domestic product (GDP) per capita, as lower-income countries tend to have low tertiary enrolment. The enrolment rate in low-income countries like Bhutan, Cambodia and Pakistan is less than 10%, while high-income countries like Australia, New Zealand and South Korea have rates that exceed 70%. These numbers suggest there is a critical need for affordable solutions to broaden opportunities for tertiary education in lower-income countries.

Table 4. Gross enrolment in tertiary education in Asia

	% of school-aged population (within 5 years of secondary-school age) enrolled in tertiary education in 2008
Republic of Korea	98.1
New Zealand	78.5
Australia	77.0
Japan	58.0
Macao, China	56.5
Hong Kong, China	55.6
Mongolia	49.8
Thailand	44.7
Malaysia	36.5
Iran (Islamic Republic of)	36.1
Philippines	28.7
China	22.7
Indonesia	21.3
Brunei Darussalam	16.0
Lao People's Democratic Republic	13.4
Cambodia	7.0
Bhutan	6.6
Pakistan	5.2

Source: UNESCAP, 2011

Mobile technology has proven to be an effective channel for providing inexpensive distance education in some Asian countries. For instance, a mobile learning project in the Philippines explored the potential of SMS-facilitated learning to improve alternative access to high-quality tertiary education. In 2004 the University of the Philippines Open University (UPOU) launched the first generation of their mobile learning programmes to support learners 'on the go' (Bandalaria, 2005). Small learning modules that included lesson contents and questions were delivered to students via mobile phones. The Mobile Technology Initiatives for Non-formal Distance Education (MIND) project is another UPOU programme that aims to extend learning opportunities to those who cannot afford or cannot be reached through traditional distance learning channels. The project, which involves a partnership with the Alternative Learning Services (ALS) of the Department of Education of the Philippines, developed distance learning modules that are integrated with SMS technology. Each module was designed to include the use of a workbook and SMS quizzes as well as audio resources (Ramos et al., 2006; Ramos and Triñona, 2009). Unfortunately, results data related to student perceptions and project sustainability from these two innovative programmes are not yet available.

Mongolia is another country that has leveraged the potential of SMS-based learning through mobile phones to deliver low-cost distance education. Sambuu (2005) argues that one of the primary challenges in ICT infrastructure in Mongolia is an insufficient number of computers in schools, and that this issue could be resolved through the provision of mobile devices. The English for Special Purposes Foundation (ESPF) and the Health Sciences University of Mongolia developed English learning modules that could be delivered via SMS to explore the viability of mobile technologies in distance learning contexts (Batchuluun, 2007; Valk et al., 2010). By developing learning materials that can be delivered via SMS services, this project aimed to reach people who could not afford existing distance learning programmes, which generally require access to a computer with a working internet connection. The project participants responded positively to the SMS learning modules, reporting that the ability to study modules at different times and get instant feedback made the SMS learning system particularly helpful (Librero et al., 2007).

Finally, the Text2Teach project in the Philippines, though not a form of distance education, is an excellent example of a successful large-scale project that utilizes mobile devices and technologies to deliver educational content to a wide range of schools. Since its launch in 2004, the Text2Teach project, which receives substantial logistical and financial support from Nokia, has provided schools with mobile learning resources in English, math and science (Natividad, 2007). Students can easily download audio and video resources using their mobile phones. Teachers can also send SMS requests for educational resources to be delivered via satellite to a school television. The project was recently expanded and now reaches approximately 4000 students in over 500 schools in the Philippines (Ayala Foundation, 2011).

PROMOTING SELF-DIRECTED LEARNING

Another key characteristic of mobile learning in Asia is a pedagogical shift toward self-directed learning. Across the region, policy-makers have prioritized programmes that promote lifelong learning, and an increasing number of educators are recognizing the importance of encouraging informal learning that happens outside of school contexts. Mobile phones have

been identified as a promising tool for facilitating self-directed learning and linking formal and informal learning spaces (Looi et al, 2009; Sharples, 2006).

Two national-level initiatives, in South Korea and Bangladesh, highlight how Asian countries are using mobile devices for self-directed learning. In 2011, South Korea became the first country in the world to declare a nationwide plan to adopt digital textbooks by 2015 (Lee, 2011). Policy-makers in South Korea anticipate that digital textbooks will provide opportunities to make learning more customizable and personalized, by offering rich content, tools and resources that can be tailored to students' abilities and interests. The adoption of digital textbooks also supports the government's plan to provide equal learning opportunities to students who are unable to attend regular lessons in schools due to health- and disability-related issues. Further, digital textbooks are expected to help students in rural areas who are often disadvantaged due to a shortage of teachers in certain disciplines and a lack of media-rich learning resources. In tandem with the national-level digital textbook initiative, information technology (IT) and telecommunications companies in South Korea have begun selling mobile learning devices, services and platforms. For instance, SK telecom launched a mobile learning platform called T Smart Learning that provides online tools and mobile devices to help students manage their own learning processes. The platform is designed to provide customizable content and tools for self-directed learning. Currently, the platform is used to support math and English learning connected to after-school programmes.

The second example of a national plan to use mobile devices for self-directed learning is Bangladesh's English in Action initiative, which aims to raise the population's English language skills by 2017. In Bangladesh, English is an important skill for competing in the job market, and motivation to learn English is generally high. Technology has been an integral part of this nationwide plan to examine and test innovative ways of teaching and learning English. For instance, BBC Janala is a multimedia platform that enables learners to study English on mobile phones as well as through an affiliated website. BBC Janala provides affordable English lessons and other educational content that people can access easily through their mobile phones. Because of partnerships with local providers, BBC Janala's services are offered at a more affordable rate than other, similar services, which can cost almost twice as much.

Mobile phones are also being used to support English language learning in Japan. For example, students who want to improve their English skills can use an interactive English learning service optimized for mobile phones. The service, called Eijiro, costs US$1.53 per month and provides users with access to an English–Japanese dictionary and other educational content. Thornton and Houser (2005) argued that because mobile phones are carried by people throughout the day, they are better suited for language learning than less portable PCs and laptops. They conducted a study that examined the impact of mobile-based English lessons on Japanese university students' vocabularies. The students received multimedia English lessons on mobile phones via email at regular intervals. Results indicated that the students in the mobile phone group performed significantly better than those who studied identical materials on websites or with paper-based resources. The researchers concluded that using mobile phones extends learning beyond class time and allows students to manage and direct their own learning at different times and locations throughout their day.

DESIGNING FUTURE LEARNING ENVIRONMENTS

The third significant characteristic of mobile learning in Asia is the movement toward designing future learning environments – educational settings enriched by technology, in which all or part of the learning experience takes place in a virtual environment. This trend is evident in more developed countries with strong ICT infrastructure such as Malaysia, Singapore and South Korea, where the government's priority seems focused on designing technology-enhanced learning environments that meet the demands of twenty-first century learners. In these countries, mobile learning, while not specifically discussed at a policy level, is subsumed under broader ICT plans to build future learning environments.

In South Korea, 'smart' has become a buzzword that describes policies promoting the integration of technology and education. For instance, in September 2011 the Ministry of Education, Science and Technology announced the *Promotion Strategy for Smart Education* (Lee, 2011). The plan describes 'Smart Education' as a customized learning system that supports learning anytime and anywhere with technology. This nationwide plan is a strategic move away from standardized approaches to education toward more personalized learning experiences. Traditionally, education in South Korea was often characterized by its uniformity in pedagogical practices and its emphasis on assessment and testing. With its strategic planning toward Smart Education, the government aspires to transform the current educational culture into a twenty-first century learning environment where collaborative, creative and critical thinking skills are fostered, at least in part, through the use of technological tools. Technology forms an integral component of the Smart Education plan. The South Korean government continues to back the development and implementation of its digital textbook project to provide online classes and assessments as well as rich learning resources. South Korean universities have also started exploring the potential for building a 'Smart Campus' in partnership with various IT companies. The conceived purpose of a Smart Campus is to provide a wireless, cloud-based infrastructure where students can easily access all relevant information about their learning progress, administrative matters and other university resources via smartphones. In addition to providing online and mobile access to information, universities are using mobile technologies to gradually shift away from the lecture model of university instruction toward a more interactive, collaborative and customizable instructional programme.

The Malaysian government has also developed a national plan, similar to the South Korean government's initiative on Smart Education, that aims to prepare learners for a knowledge-based society through the use of ICT. As part of the government's Smart School programme, this strategic plan includes a roadmap with four implementation waves. In Wave 1 (1999–2001), ICT pilot projects were launched in eighty-seven schools in Malaysia; in Wave 2 (2002–2005), new post-pilot projects were implemented based on lessons learned from the previous stage. Wave 3 (2005–2010) was intended to make all schools 'smart' by extending digital technologies to all institutions, while Wave 4 (2010–2020) plans to ensure that the pedagogical ideas underlying the Smart School concept become pervasive in all Malaysian schools. Mobile technology is considered an important part of this large-scale plan. The government's Smart School Roadmap 2005–2020 refers to mobile phones specifically:

> A scheme is to be instituted in order to help all children buy an access device for mobile learning for use during the child's school-going days. This is one of the solutions, schools and parents can consider as part of school governance. (MSC, 2005, p. 47)

According to Mohamad and Woollard (2010), mobile phones are becoming more prevalent in Malaysia, and students in general have a positive attitude toward mobile learning.

Singapore is another country with systemic nationwide planning in ICT. The project FutureSchools@Singapore, launched in 2007, is the government's initiative to build a new model for education by exploring innovative pedagogical approaches to the integration of ICT into school curricula (Koh and Lee, 2008). Schools identified as 'future schools' receive funding to transform their school environments by infusing ICT into the school's curriculum. The Ministry of Education expects to spread the pedagogical innovations developed in 'future schools' to the rest of the schools in Singapore. While the use of mobile technology was not mentioned specifically in the plan for FutureSchools@Singapore, some schools in the programme have already started exploring the potential of mobile learning through pilot projects. For instance, Crescent Girls' School, one of the pioneering 'future schools', has integrated the use of tablet devices into lessons. All students at the school use tablet devices loaded with interactive digital textbooks. In another example, Nan Chiau Primary School, featured as a new 'future school' in 2011, has been experimenting with the integration of mobile devices into school curricula through various research-based projects since 2005.

POTENTIAL ISSUES

The use of mobile technologies for educational purposes remains a controversial issue in Asia. Students' mobile phone use in schools has raised some social concerns about mobile technologies as distracting, addicting and possibly harmful, as students sometimes use mobile devices to engage in cyber-bullying and other inappropriate behaviours. School administrators and teachers often conceive of mobile phones as disruptive to the learning process in classrooms, thus making the initial adoption of mobile learning slow and challenging. To overcome these issues, governments and institutions may need to set clear guidelines or policies on the use of mobile phones in school settings.

Interestingly, some researchers have suggested that the ability of mobile phones to 'disrupt' traditional learning may not always carry a negative connotation, and could in fact create a positive impetus to challenge current educational practices (Christensen et al., 2008). For example, the Seamless Mobile Learning project in Singapore found that the use of mobile phones positively influenced the way students and teachers thought about how teaching and learning should and could be done (Looi et al., 2009). Through the use of mobile phones, students became more self-directed and inquiry-oriented in their learning, and at the same time, teachers also began to explore how the unique capacities of mobile phones could be leveraged to create meaningful learning experiences for students.

MOBILE LEARNING POLICES

This section presents the results of the questionnaire study that was conducted in October 2011 to investigate the status of mobile learning in Asia at the policy level. Mobile learning experts in eight countries – China, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand – responded to the survey. The findings are grouped according to the questionnaire topics.

PUBLIC POLICIES ON MOBILE LEARNING

Study participants were asked about the level of government support for mobile learning. Four of the participants indicated that the use of mobile phones in education was being encouraged through specific programmes or projects with dedicated public funding. The same number of participants also indicated that mobile learning was being supported through dedicated private funding. Two participants referenced initiatives led by institutions and engaged individuals, and one participant indicated the presence of government initiatives, including specific measures and incentives, to support mobile learning. These results suggest that mobile learning enjoys a relatively high level support from a majority of governments in the responding countries. Only one participant stated that the government was not actively supporting the use of mobile phones in education. See Table 5 for specific countries' responses.

Table 5. Is your government actively supporting the use of mobile phones in education?

Yes, through initiatives by institutions and engaged individuals	China Malaysia
Yes, through specific projects or programmes with dedicated public funding	Japan Malaysia Singapore Taiwan
Yes, through specific projects or programmes with dedicated private funding	Japan Malaysia Singapore South Korea
Yes, through government initiatives including specific measures and incentives	Malaysia
No, not really	Thailand
Do not know	
Other	Indonesia

Participants were also asked about the existence of government strategies or policies, issued by the Ministry of Education or other government bodies, that relate specifically to mobile learning. While the use of mobile phones in education is actively supported through various funding sources and initiatives in most of the countries surveyed, at the national level it appears that none of the countries have a clear strategy or policy in place on mobile learning. Only one respondent indicated that such a policy is in development, while three participants reported that there were no plans to develop this type of policy currently nor in the future. Four participants indicated that policies on the use of mobile phones in education are under discussion within their Ministries of Education. See Table 6 for specific countries' responses.

Table 6. In your country, does the Ministry of Education (or another public agency in the education sector or a different area of government) have a clear strategy or policy regarding the use of mobile phones in education?

Yes, in operation	
Yes, in development	Korea
Not yet, but under discussion	China Malaysia Singapore Thailand
No, with no preparations yet	Japan Taiwan
No, we do not anticipate this in the near future	Indonesia
Don't know	

On the whole, most of the participants reported that there were no government-level policies specific to the development of mobile learning for teaching and learning in schools. An analysis of respondents' qualitative comments revealed that mobile learning is sometimes included under the macro-context of policy plans about ICT, distance education and lifelong learning. Examples include Indonesia's National Education Law supporting distance learning, South Korea's Smart Education plan, and Thailand's National IT Strategic Plan 2020.

LEVEL OF MOBILE LEARNING ACTIVITIES ACROSS EDUCATIONAL SECTORS

Each participant was asked to indicate the level of mobile learning activities for the various educational sectors, from primary education – International Standard Classification of Education (ISCED) 1 – to tertiary education (ISCED 5). Each level was defined as follows:

- **Low:** There is some activity, but it is just in the early stages of development, probably with sporadic activities rarely going beyond one particular school or institution.
- **High:** There are programmes or activities that have reached a critical mass of schools or learners, so as to become publicly noticeable.
- **Very high:** There are programmes or activities that can be considered widely used by schools or learners.

As Table 7 shows, the overall data indicate a consistent pattern across all of the respondents' countries: there are high levels of mobile learning activities in the tertiary education sector and low levels of mobile learning activities in the primary to post-secondary sectors. The participants stated that most of the initiatives at the low level remain in the early developmental stage. Across all eight countries, tertiary education institutions have the highest number of active mobile learning initiatives. The participants reported that several research projects have been implemented by universities and other higher education institutions to explore the potential of mobile devices in education, and that the government is supportive in providing resources and funding for such research.

Table 7. Level of mobile learning activities across educational sectors

		China	Indonesia	Japan	S. Korea	Malaysia	Singapore	Taiwan	Thailand
Primary (ISCED 1)	Non-existent							✔	
	Low	✔	✔	✔	✔	✔	✔		✔
	High								
	Very high								
Lower secondary (ISCED 2)	Non-existent							✔	
	Low	✔	✔	✔	✔	✔	✔		✔
	High								
	Very high								
Upper secondary (ISCED 3)	Non-existent								
	Low	✔	✔	✔	✔	✔	✔	✔	✔
	High								
	Very high								
Post secondary, non-tertiary (ISCED 4)	Non-existent				✔				
	Low	✔				✔	✔	✔	✔
	High			✔					
	Very high								
Tertiary (ISCED 5)	Non-existing								
	Low	✔				✔			✔
	High		✔	✔	✔		✔	✔	
	Very high								

Some speculations can be made about why mobile learning activities seem to be more concentrated in higher education. First, it is relatively easy for higher education institutions to establish partnerships with IT and telecommunications companies for mobile learning initiatives. For instance, several South Korean universities have partnered with large companies such as KT (Korea Telecom), LG and Samsung to develop wireless university campuses where students with smartphones can easily access necessary information and resources on the move. This type of collaboration is facilitated by the fact that universities usually have a fairly robust technological infrastructure in place, making the implementation of mobile learning projects relatively quick and inexpensive, and university students are generally enthusiastic about mobile learning opportunities. The cost and availability of mobile devices is another important factor that may explain the lower level of mobile learning activities in primary and secondary education. There is no expectation for universities to provide technology directly to students. Since older students are likely to possess their own mobile devices, universities can take advantage of existing devices to encourage mobile learning activities, without having to purchase equipment for students. Primary and secondary

schools, on the other hand, often need to either provide mobile devices or subsidize the purchase of mobile devices for students, which may slow the adoption of mobile learning. Lastly, higher education institutions tend to have more flexibility and autonomy than primary and secondary schools in terms of curriculum design and strategic planning, which may allow them more space to explore new methods of teaching and learning, including mobile learning. In most of the countries surveyed, primary and secondary schools are required to follow the guidelines of national curricula set by the Ministry of Education in order to prepare students for high-stakes national examinations. Under the pressure of such a competitive culture of assessment, teachers may default to traditional tried and tested approaches rather than exploring new instructional strategies using mobile phones.

ROLE OF KEY STAKEHOLDERS

Study participants were asked about the roles of key stakeholders involved in the promotion or prevention of mobile learning in schools. As Table 8 demonstrates, the majority of respondents indicated that governments and higher education institutions play a critical role in encouraging mobile learning in Asia. Other important stakeholders who are perceived as promoting mobile learning include regional and local educational authorities, telecommunications providers, students, and education specialists and scholars.

Responses about the role of teachers and parents were mixed, indicating that these stakeholders may play dual roles in both the promotion and the prevention of mobile learning. While parents and teachers generally appreciate the educational opportunities afforded by mobile technologies, they are equally concerned about the potential problems associated with the use of mobile phones in schools. Such conflicting views may arise from concerns about the potentially harmful effects of mobile phones, including internet or gaming addictions, or access to inappropriate online content. This finding presents some important policy implications. When formulating plans and initiatives for mobile learning, policy-makers should consider the opinions of multiple stakeholders in order to gain a balanced view about the benefits as well as the potential drawbacks and challenges associated with the use of mobile phones in educational contexts. Governments, local authorities and schools also need to establish clear policies on what constitutes acceptable use of mobile phones in schools, and to obtain parental consent in planning and implementing mobile learning activities in school contexts.

Table 8. Perceived stakeholders involved in promoting or preventing the use of mobile phones in education

Stakeholder	Use	Prevention of use	Not applicable
The government	6	0	1
Regional educational authorities	4	0	3
Local educational authorities	4	0	3
Telecom providers	7	0	1
Mobile phone/hardware makers	6	0	1
Teachers	2	4	2
Students	6	0	2
Parents	1	3	3
Education specialists/scholars	6	0	2

MAJOR FACTORS INFLUENCING MOBILE LEARNING

There are multiple factors influencing public policies and social attitudes about the use of mobile phones in education. Study participants were asked to identify and describe the social, economic and political factors that function as (a) enablers, (b) barriers and (c) success factors for mobile learning initiatives and policies. Table 9 presents the summary of key themes that emerged from the analysis of the responses.

Table 9. Major factors influencing mobile learning

Enablers	• Initiatives at the government and ministry levels • Research in higher education institutions • Accessibility, connectivity and affordability of mobile devices
Barriers	• Cost of mobile devices and subscriptions • Concerns about the misuse of mobile phones • Teachers' and parents' mindsets and attitudes • Health-related issues • Lack of teacher training and support • Lack of high-quality educational content
Success Factors	• High penetration of mobile phones • Infrastructure: wireless network, mobile applications • Teacher professional development on mobile learning

ENABLERS

Key factors that enable mobile learning include government initiatives; active research in higher education settings; and the accessibility, connectivity and affordability of mobile phones. While there are no formal government-level policies on mobile learning at the present time, the majority of governments in the participants' countries appear to be supporting mobile learning by providing necessary funding and resources to encourage mobile learning research. At this stage, it could be argued that collaboration between Ministries of Education and higher education institutions is the main driver for exploring the potential of mobile phones for education. Such collaboration is important, as educators and policy-makers must gather research-based evidence before making any formal recommendations at the policy level. Another critical driver is the widespread availability of internet-ready mobile devices at increasingly affordable prices. As powerful mobile devices like smartphones become more pervasive, there is little doubt that they will be adopted for educational purposes.

BARRIERS

Several factors were identified as barriers to the adoption of mobile phones in education. In spite of the high penetration rate of mobile phones in Asia, the cost of mobile devices and mobile communication subscriptions appears to be a critical barrier to mobile learning, as not all students, teachers and schools can afford mobile devices and accompanying data plans, and some students may own basic mobile phones while others have smartphones and tablets, which introduces equity issues. Concerns about students' misuse of mobile phones pose

another key barrier. Problems such as internet and gaming addictions or access to unsuitable content online may lead some schools to ban mobile phones outright, rather than exploring their possibilities for education. Moreover, due to the lack of high-quality educational content and resources available through mobile platforms, the general public is inclined to see mobile phones as devices used for primarily for communication and leisure, rather than powerful educational tools.

Another fundamental barrier lies in the mindsets of parents, teachers and students. A survey study conducted with 800 parents of children ranging from ages 3 to 10 revealed that most parents are concerned about the extensive use of digital media including mobile phones (Takeuchi, 2011). In particular, parents worry that the overuse of digital media decreases the amount of exercise and social interaction young children engage in, which may have harmful effects on their physical and psychological development. Teachers and students in Asia also tend to prioritize examinations and assessment in general, which may reinforce traditional approaches to instruction, such as textbook-based lessons, rather than new methods like mobile learning. For instance, despite the South Korean government's push to adopt digital textbooks, teachers have expressed concerns that traditional textbook approaches will persist as the preferred method of instruction due to the national high-stakes exams, which are based on printed, non-digital formats (Shin, 2011).

Health-related issues surrounding the use of mobile phones are also a factor, though some of these objections are controversial. While the World Health Organization (WHO) recently announced that radiation from mobile phones may increase the risk for certain cancers, no conclusive scientific evidence has clearly established a relationship between mobile phone use and health issues (Dellorto, 2011; Walsh, 2011). Some people have also raised concerns that digital addictions and excessive screen time may cause eye strain, fatigue, lack of concentration and an inability to stay focused on tasks.

SUCCESS FACTORS

Factors contributing to the success of mobile learning initiatives in Asia include the high penetration rate of mobile phones in recent years; increasingly robust IT infrastructure, such as wireless networks and mobile applications; and professional development for teachers on mobile learning. In South Korea, for instance, efforts by the government and private companies to build strong IT infrastructure for wireless environments have encouraged and facilitated mobile learning in and outside of schools. It is also interesting to note that both technological and pedagogical aspects were mentioned as success factors. Teachers play a vital role in implementing mobile learning projects and ensuring their success. When designing mobile learning initiatives, it is essential to provide teachers with professional development opportunities in which they can gain the necessary knowledge and skills to effectively integrate mobile devices into their instruction.

CONCLUSIONS AND RECOMMENDATIONS

While several countries have developed strategic plans to integrate ICT into education, very few national-level policies in Asia specifically address mobile learning, and most mobile learning initiatives are small-scale and ad hoc. All participants in the questionnaire study indicated that the level of mobile learning activities in primary and secondary schools remains low in their countries. Overall, findings suggest that mobile learning in Asia has yet to move beyond the emerging and experimental stage.

While recognizing the tremendous diversity of the Asian region, this review reveals that countries tend to fall into one of three main categories in terms of their engagement with mobile learning:

- **Category 1:** Countries with a mature mobile market, high penetration of mobile phones and strong ICT infrastructure (e.g. Malaysia, Singapore and South Korea). Mobile learning is included under the broad context of national-level ICT policies.

- **Category 2:** Countries with a growing mobile market, medium to high penetration of mobile phones and basic ICT infrastructure (e.g. Bangladesh, India, Pakistan and the Philippines). Mobile phones are used for distance learning and in informal learning contexts.

- **Category 3:** Countries with an emerging mobile market, low to medium penetration of mobile phones and weak or basic ICT infrastructure (e.g. Afghanistan and Nepal). Mobile learning activities are scarce.

Category 1 includes countries with relatively mature markets for mobile phones and strong ICT infrastructure, such as Singapore and South Korea. Advanced technological infrastructure and broad ICT policies that can be applied to mobile learning facilitate the implementation of mobile learning projects. Category 2 comprises countries that place a strong emphasis on expanding educational opportunities through the use of mobile phones. In these countries, which include Bangladesh and India, mobile learning is generally classified under the overarching theme of distance education and informal or lifelong learning, and projects tend to focus on the potential of mobile phones to extend learning opportunities to people who do not have access to traditional educational settings or resources. Category 3 consists of countries like Afghanistan and Nepal with weak or basic infrastructure for ICT in education as well as relatively low penetration rates for mobile phones. Mobile learning is still a new concept in these countries. At the same time, there is a great potential for growth and development, as the provision of affordable mobile devices may have a substantial impact on expanding educational access for marginalized and disadvantaged populations.

POLICY CONSIDERATIONS

In spite of some significant activities observed in Category 1 and Category 2 countries, this review suggests that mobile learning is still a relatively new phenomenon in Asia, which has not yet been addressed by education policy-makers. For mobile learning to have a significant effect on teaching and learning, coordinated efforts must be made at the policy level to support the use of mobile devices for education.

Research and literature on educational reform indicates that education policies need to promote a bottom-up strategy toward change rather than use a top-down approach. This section offers a set of policy considerations drawn from a systemic perspective that involves the micro, meso and macro levels of education (Looi et al., 2011). At the macro level, Ministries of Education and policy-makers focus on providing broad guidelines and directives for nationwide implementation, while micro-level actors, such as school administrators and teachers, enact small-scale and concrete projects that respond to local needs. The meso level, which includes exploratory activities led by research institutions, private companies and NGOs, is critical to policy-making, as it connects the macro and micro levels. Meso-level actors can help translate macro-level policies into practice and work closely with micro-level actors to bring about actual changes in education (Jephcote and Davies, 2004). Table 10 shows the main actors involved in each level and the roles they play.

Table 10. Main actors and roles at macro, meso and micro levels

	Main Actors	Roles
Macro level	Ministries and policy-makers	Strategic policy planning for sustainability and scalability
Meso level	Research institutions, telecommunications providers, IT companies and NGOs	Mediating roles in educational policy processes
Micro level	School administrators, teachers, students and parents	Construction of classroom-based interactions

The sustainability and scalability of mobile learning efforts is largely dependent on the cooperation and coordination of actors from all three levels. This multi-level concept does not imply any linearity of events, power or influence; for instance, policies do not necessarily need to originate on any particular level (Radford, 2008). Instead, macro, meso and micro policies should co-evolve, self-organize and shape each other (Uhl-Bien and Marion, 2009). It is therefore possible that well-crafted and sustainable meso- and micro-level mobile learning policies might blossom in the absence of unifying macro-level frameworks. When this happens, the government should respond by supporting and accommodating new initiatives emerging from the meso and micro levels. For example, a macro-level policy might be changed to encourage more partnerships among meso- and micro-level actors actively engaged in mobile learning, or a new policy could be formulated to prevent the encroachment of consumerism and commercialization in schools.

In spite of the potential for grass-roots mobile learning efforts to grow and expand, there is still a need for clear national-level policies, plans and actions to promote the use of mobile phones in education. It is evident that robust technological infrastructure is a prerequisite for mobile learning but not the ultimate factor in determining the success and impact of mobile

learning efforts. Governments need to communicate with key stakeholders on the meso and micro levels to ensure their support and cooperation. In many cases meso-level actors such as research institutions and NGOs can play important roles in facilitating communication and agreement between policy-makers at the national level and teachers, administrators, students and parents at the local level. Telecommunications companies also need to be assured of the potential and stability of the mobile learning 'market', in order to encourage collaboration, joint projects and investments. Likewise, research institutions require governmental interventions in the form of clear directives, goals and funding to support their research. At the micro level, it is important to encourage the development of institutional or school-level policies that consider the pivotal role of teachers and learners in implementing mobile learning initiatives. Rules and guidelines about logistical and pedagogical issues concerning mobile learning implementation should be left to micro-level actors to determine, based on local needs and contexts.

Singapore provides an excellent example of the successful interaction of the macro, meso and micro levels in education. The government has developed overarching educational policies that were formulated based on several rounds of feedback from actors on all three levels (Toh and So, 2011). While the government has not designed formal policies specific to mobile learning, macro-level policies on the use of ICT in education have been implemented systematically and in alignment with national priorities. The iN2015 initiative, unveiled in 2006, aspires to transform the country into an 'intelligent nation' within a decade. Under this initiative, the government identified the Next-generation National Infocomm Infrastructure (NII) as a strategic enabler for Singapore's economic restructuring and competitiveness. The iN2015 initiative describes three strategic goals for the education sector: (1) create an enriching and personalized learner-centric environment in educational institutions; (2) build a nationwide education and learning infrastructure; and (3) position Singapore as a centre for innovation in the use of ICT in education (IDA Singapore, 2006, p. 20). To achieve these goals, the government has launched the Edvantage programme, which emphasizes the importance of connectivity anytime and anywhere, so that learning can transcend the four walls of the classroom. The Infocomm Development Authority (IDA), the government body in charge of Edvantage, works with schools to create 1:1 (one device per student) learning environments and wireless campuses to enable students to learn on the move and be connected to a suite of learning resources at all times.

Singapore also has a Masterplan for ICT in Education. The overall objective of the third Masterplan (2009–2014) is to equip students with critical competencies, such as the inclination and ability to engage in collaborative and self-directed learning, that are required for success in a knowledge-based economy (MOE Singapore, 2008). To achieve this goal, the government focuses on creating a pervasive culture of innovative ICT practices. As part of this overarching vision, mobile technologies serve to enhance the provision of ICT tools and to create more flexible learning environments. The government has also provided substantial funding and resources for mobile learning at the national level, by supporting research centres and offering grants to promote research related to mobile learning. FutureSchools@Singapore and LEAD ICT@Schools are government-initiated programmes to support schools exploring new technologies, and to facilitate the sharing of innovative ideas and practices among schools. As mentioned earlier, Crescent Girls' School and Nan Chiau Primary School – designated 'future schools' – have integrated mobile devices into school curricula.

Meso-level actors in Singapore, such as researchers at higher education institutions, have responded to macro-level policies by conducting comprehensive school-based research projects to better understand the interrelationships between mobile technologies and informal learning spaces (Looi et al, 2010). Such research aims to inform the government about the potential of mobile technologies to bridge the gap between formal and informal learning. As these examples illustrate, the developmental process of education policies in Singapore is iterative and co-evolving, with the government constantly seeking input and feedback from the meso and micro levels to develop and revise macro-level policies. Seamless and fluid communication across all three levels is critical to formulating clear policies for ICT and mobile learning.

THE FUTURE OF MOBILE LEARNING IN ASIA

Finally, it is useful to examine mobile learning in Asia through the lens of building twenty-first century skills and schools. Kozma (2011) proposed the Knowledge Ladders framework that differentiates educational policy approaches into four broad categories: basic education, knowledge acquisition, knowledge deepening and knowledge creation. At the most fundamental level, the main goal of education is to provide opportunities for developing basic literacy and numeracy skills. The knowledge acquisition approach aims to increase citizens' basic competencies to enable them to better participate in the global economy. The knowledge deepening approach equips and empowers individual citizens with the necessary knowledge and skills to solve complex issues and real-world problems. Lastly, the goal of the knowledge creation approach is to prepare students to become lifelong learners who will innovate and produce new knowledge.

When the Knowledge Ladder framework is applied to mobile learning initiatives in Asia, it becomes increasingly clear that existing mobile learning efforts are advancing the basic education and knowledge acquisition approaches only. Many projects position mobile phones as a tool to deliver learning materials and resources to students. Few projects, however, have explored the potential of mobile phones for knowledge deepening or knowledge creation. This finding may not be surprising given that mobile learning is a relatively new field in education. Also, in developing countries the top priority for educators and policy-makers is to provide opportunities for basic education, and mobile phones are often considered a viable option for achieving this goal.

Moving forward, a vision for future mobile learning in Asia requires a macro-level plan about how countries can progress from basic education and knowledge acquisition to learning that emphasizes knowledge deepening and knowledge creation. To build long-term, sustainable mobile learning programmes, educational researchers and policy-makers need to consider the different possibilities for using mobile phones in the knowledge acquisition, deepening and creation stages. By leveraging the potential of mobile devices, and developing comprehensive policies and a clear vision for the future, countries in Asia can move toward an educational system that provides quality education to all.

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

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