The Implementation of Mobile Learning in Asia: Key Trends in Practices and Research

Daniel Churchill, Mark Pegrum, and Natalia Churchill

Contents

This chapter was written in collaboration with the following country report co-authors, who retain responsibility for the claims made and references cited in their respective contributions: Spencer Benson, University of Macau; Kurt Bredenberg, Kampuchean Action for Primary Education; Chun-Yen Chang, National Taiwan Normal University; Phonekeo Chanthamaly, National University of Laos; Dang Hai Dang, Hanoi Open University; Aji Divakar, Murdoch University; Vorasuang Duangchinda, Sripatum University; Christopher Fulton, University of Macau; Michael Gallagher, The University of Edinburgh; Eric Charles Hawkinson, The University of Fukuchiyama; Rozinah Jamaludin, Universiti Sains Malaysi; Thazin Lwin, Yangon University of Distance Education; Saiful Omar, Universiti Teknologi Brunei; Melissa Orencia, Philippine Normal University; Kumaran Rajaram, Nanyang Technological University; Afzaal Seyal, Universiti Teknologi Brunei; Javier Solá, Open Institute, Cambodia; Yanjie Song, The Education University of Hong Kong; Linawati, Udayana University; and Tianchong Wang, The Education University of Hong Kong.

D. Churchill (✉)
Faculty of Education, The University of Hong Kong, Hong Kong, People's Republic of China
e-mail: dchurch@hku.hk

M. Pegrum
The Graduate School of Education, The University of Western Australia, Crawley, Australia
e-mail: mark.pegrum@uwa.edu.au

N. Churchill
Faculty of Education, The University of Hong Kong, Hong Kong, People's Republic of China

The Singapore International School (SISHK), Hong Kong, People's Republic of China
e-mail: hk_natalia@yahoo.com

J. Voogt et al. (eds.), *Second Handbook of Information Technology in Primary and Secondary Education*, Springer International Handbooks of Education,
https://doi.org/10.1007/978-3-319-53803-7_54-1

Abstract

This chapter explores the implementation of mobile learning in Asia, with a particular emphasis on K12 education. A series of 17 individually authored or co-authored country-by-country reports gives an overview of the penetration of mobile devices and the mobile Internet in society and in education. These reports indicate the ways in which such technologies are and are not being employed in teaching and learning, reflecting on the roles of the public and private sectors as well as schools and teachers in their implementation. Common mobile educational practices and their pedagogical underpinnings are outlined, as are associated research projects and publications. The chapter concludes by integrating insights from these reports to establish key regional trends and make recommendations for future mobile learning research.

Keywords

Mobile learning in Asia · K12 mobile learning · Mobile devices in education · Mobile technologies for teaching and learning · Mobile educational practices · Mobile learning research

Introduction

Mobile learning is rolling out at considerable speed across the world. Taking as its springboard the global overview in Churchill and Pegrum (2017), and the associated special issue of *Interactive Technology and Smart Education* (vol. 14, no. 2) on the

theme of "Mobile learning, emerging learning design and learning 2.0," this chapter zeroes in on Asia, digging more deeply into mobile learning practices and research in 17 countries and locations across the region.

Scholars and practitioners from a large number of countries in Asia were invited to contribute short reports on the state of mobile learning in their various contexts, with reports being received from: Brunei, Cambodia, China, Hong Kong, India, Indonesia, Japan, Laos, Macau, Malaysia, Myanmar, the Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam. It should be noted that for the purpose of this survey of mobile learning in different locations, it was logical to treat Hong Kong and Macau (each a Special Administrative Region, or SAR, of China) as well as Taiwan as separate contexts, each with its own distinctive trends and practices.

In order to ensure some commonality between reports, while simultaneously avoiding imposing too many restrictions on the diversity of views, general guidelines were provided in the form of key points which respondents were invited – but not required – to consider. It was suggested that respondents could comment on mobile Internet penetration and educational access in their locations; general trends in mobile technology adoption; major educational platforms or apps used or developed; major government or university educational initiatives, including in teacher education; major research projects and publications; and predictions for future mobile learning developments.

Individual authors or co-authors remain responsible for the reliability, comprehensiveness, and representativeness of their reports, as expressed in their own particular voices. It is important to recognize that each report represents a unique view of a given country or location, dependent on the perspectives and positionality of its authors or co-authors. As such, the reports should not be seen as complete accounts of mobile learning in each location, but rather as snapshots taken from the viewpoints of informed educators with significant local experience. It is hoped that bringing together such viewpoints will enlarge the understandings of a global audience of educators who may have had little personal contact with some of these widely varying settings.

The reports have been edited as minimally as possible for consistency, style, and length (though considerable variations in length are still present, reflecting differences in the original reports). Once the reports had been edited, they were coded for key themes by the three main authors of this study, who then collaboratively agreed on the presentation of these themes in the final discussion. The entire chapter, including all country reports and the culminating discussion, was then sent back to report authors for checking and to allow them to make additions, adjustments, and suggestions in light of the companion reports and the discussion themes identified. This led to a final review of the article by the main authors.

Country Reports

Brunei by Saiful Omar and Afzaal Seyal (Universiti Teknologi Brunei)

In 2016, smartphone penetration in Brunei reached 99%, total tablet ownership reached 62%, and laptop ownership increased to 93% (AITI 2016). The top four social media applications used via mobile technology are: WhatsApp (97.3%), Facebook (91.7%), Instagram (87.4%), and YouTube (80%). Individuals in the 15–34 age group have been the most active mobile and Internet users, engaging primarily with WhatsApp, Facebook, and gaming, and accessing content such as movies and TV series. At the same time, individuals in the 35–54 age group are more active with Internet banking and government e-services.

More than 90% of the Internet subscribers have access to fixed and mobile broadband (AITI 2016). Most users spend significantly more time accessing Internet information and social networks, taking pictures, sending emails, and accessing entertainment via mobile technology than via any other Internet-enabled device.

The use of mobile technology for learning is still at early adoption stage in Brunei. Nevertheless, the Ministry of Education Brunei Darussalam has been keen to explore possibilities for implementing mobile learning in schools, while the higher education sector appears to be exploring possibilities more actively. For example, the Universiti Teknologi Brunei (UTB) is taking a leading role in the adoption of e-learning. The School of Computing & Informatics of the UTB has been focusing on developing various learning apps through their undergraduate students' final year projects. Some examples of recent mobile app projects are: "Phonic Learning App," "Islamic Etiquette Mobile Game," "Enhancing the Learning of Malay Vocabulary," "Learning Numbers 1–20," "Year 1 Science," and "Gulintangan Kitani."

From a research perspective, more studies are needed to develop frameworks and explore the adoption and effectiveness of mobile technology. Such research might focus on exploring user perceptions, acceptance, and other critical factors for the successful implementation of mobile learning. A number of studies of student adoption of mobile technology in education at the UTB produced interesting results. Seyal et al. (2014) used a standard instrument to capture students' responses on the three basic constructs of the Technology Acceptance Model (TAM), including Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Attitude. The results suggest that PU remains the significant determinant of attitude, which in turn predicts intention for adopting mobile learning. Furthermore, Seyal et al. (2015) investigated student mobile learning adoption attributes based on the Diffusion of Innovation (DOI) framework and constructs including relative advantage, compatibility, complexity, observability, and trialability. The results suggest relative advantage and compatibility are the key determinants of adoption. Finally, Seyal et al. (2017) applied the Theory of Planned Behaviour (TPB) framework to the study of adoption attributes of mobile learning, including Subjective Norms (SN), Attitudes, and Perceived Behavioural Control (PBC). The results suggest that only attitude remains a significant determinant of adopting mobile learning technology. The

results of these three studies suggest that the DOI framework is the most suitable predictive model of students' adoption of mobile learning in Brunei.

Cambodia by Kurt Bredenberg (Kampuchean Action for Primary Education) and Javier Solá (Open Institute, Cambodia)

The technological context in Cambodia is changing rapidly. By 2014, the number of mobile subscribers had topped 20 million users (Sokhean 2014). In 2016, the Open Institute reported that 94% of Cambodians aged 15–65 had a phone and 48% of them a smartphone, a number that has grown very fast over the last 4 years (Phong et al. 2016). Urban youth under 25 are the group that is growing fastest in the use of smartphones and the Internet. For the education sector, this is opening up the possibility of schoolteachers and high school students using technology for teaching and learning.

The Ministry of Education, Youth and Sport (MoEYS) has decided to introduce Information and Communication Technologies (ICTs) as a subject starting in Grade 4 (it is currently only in Grades 11 and 12). It will be very difficult to access any devices at primary level, and even at lower secondary level (Grades 7–9), but the lower secondary part will be keyed to mobile devices, not computers, as no computers will be available for more than 1,000 lower secondary schools. Computers have already been partially introduced in upper secondary levels, and this will continue. At lower secondary level mobile devices, probably mostly used by the teachers, will support the teaching of Science, Technology, Engineering, and Maths (STEM) subjects.

Interesting work is also being carried out with early grade literacy. Nationwide tests of reading in Cambodia over the last several years have shown very low scores, with 54% of children failing a test of basic reading. As a result, the MoEYS is now revising its reading curricula; in addition, a number of civil society organizations have started to invest heavily in developing literacy software programs in the Khmer language with close linkages to the newly revised national reading curriculum. Notable educational software products in this regard include "Aan Khmer" (Grades 1–3) and "Smart Books" (Grades 2–3), which are closely linked with reading benchmarks set out by the Ministry's Department for Curriculum Development. The profusion of mobile devices and use of social media networks in the country offer another new opportunity for dissemination of e-book applications.

Khmer language reading instruction in Cambodia has never really involved the use of differentiated classroom literacy structures that can give struggling readers the confidence they need to acquire reading skills (Abadzi 2010). The current readers are structured as a one-size-fits-all approach for children of all levels, with little guidance provided to teachers about how to address the needs of such children. Even if the MoEYS had developed print-based readers as a supplement, printing costs would be problematic, with textbook availability ratios for core subject textbooks hovering at around 69–70 per 100 students in Grades 1–3. The development of software

programs such as Smart Books, which are electronic basals supplementing the core readers, offers significant promise for modulating reading programs according to the needs of individual readers. These basal e-readers possess special interactive features (e.g., digitized quizzes, animations, and audio to promote "multisensory" reading), combined with teacher protocols to promote leveled instruction that will help address the lack of differentiated literacy structures in classrooms (e.g., reading groups), which in turn will aid struggling readers.

Some of the key development partners supporting the MoEYS on literacy have also made significant strides in the electronic administration of Early Grade Reading Assessments (EGRA) by using a well-known software application called "Tangerine," developed by USAID and the Research Triangle Institute.

One promising set of developments concerns teacher education. As more than 50% of teachers have smartphones and access to Facebook, this has become a priority channel to reach them with microtraining; indeed, the MoEYS has a Facebook page with over 1.8 million followers. A targeted intervention can be seen in a set of applications from the Open Institute and Voluntary Service Overseas (VSO) which are aligned to the English curriculum in Grades 4–6, and allow teachers who lack confidence in English to listen to what they are supposed to say in English during class; there are menus which allow them to go to any lesson or activity and listen to what they have to teach. Moreover, a new Master Plan for ICTs in Education is currently in development. This will place mobile at the center of the Ministry's teacher training efforts for in-service training. All materials will be designed in a microtraining format (1–2 min per video) so that they can be flexibly used in different channels.

China by Tianchong Wang (The Education University of Hong Kong)

The number of smartphone users in China has been skyrocketing and is estimated to reach 601.8 million by the end of 2017 (Statista n.d.). With penetration of smart devices continuing to rise, mobile learning in China is rapidly moving from concept to reality in basic education and beyond.

One of the most noticeable government-led efforts towards mobile learning in recent years has been the introduction of the e-Schoolbag for improving education quality. The e-Schoolbag was first established in Shanghai in 2010 with support from the East China Normal University, then in Beijing and several other major cities in 2011, as an overarching concept of large-scale one-to-one implementation of tablets with preloaded digital textbooks for selected K12 schools. It was intended to provide a multimedia, interactive, and collaborative learning environment where students could access digital content that is more pleasurable and conducive to learning, either inside or outside of classrooms. At the start, the initiative suffered from content being dominated by textbook publishers (Wang and Towey 2012). However, with the hype around the streaming video-based Wei Ke (微课, literally "Micro-Course") in the last few years, a growing number of grassroots, teacher-designed learning materials have been developed for use via the e-Schoolbag platform

(Gu et al. 2016). Despite the growing availability of learning materials, and an increasing number of schools joining the e-Schoolbag initiative, there is still hesitation among school leaders concerning students becoming distracted in class, as well as possible negative effects on eyesight (Li 2013). Students' abilities to use mobile technologies to learn vary due to the socioeconomic status or the sociodemographic origins of their families, thus reinforcing the resistance of the school leaders to the introduction of the e-Schoolbag in many areas (Li 2013). Hesitation aside, it must be admitted that in a culture of classroom practice that is perceived by many educators as often being teacher-led, the effect of this project seems to be less pedagogically transformative than expected (He and Wray 2017).

Despite the regional disparity of development in China, there have been mobile learning field projects in the provinces of the Central-Western Region to explore how mobile technology can expand access to education and advance literacy and numeracy. For example, a pilot program, spearheaded by a government think-tank called the China Development Research Foundation, aimed to bridge the education gap between the country's urban and rural communities with the aid of a mobile-based learning platform, Mobiliya Edvelop (Aki 2015). Conducted at eight schools in the Qinghai and Guizhou provinces, the pilot program equipped students and teachers with tablets loaded with a system that allowed them to tune into live-streamed or prerecorded video-based learning resources provided by teachers of partner schools in urban areas. It was expected that such a model could be scaled up in order to address the issue of the lack of highly qualified teachers in rural schools, although the outcomes of this program have yet to be reported and analyzed.

In parallel with these government-led or government-supported initiatives and programs that target formal education, the last few years have seen the emergence of a new digital ecosystem, notably incorporating apps from the private sector, as a platform of knowledge distribution with "bite-sized" pieces of learning content. While a small number of educational apps are mapped to national or regional curriculum targets, and designed for use in classroom or homework settings, the majority are intended mainly for informal, personalized, on-demand, self-directed learning. Among these apps, the most popular category is English language learning, which also mirrors the huge English language learning demand in the country (Ambient Research 2015). One reason such a category is favored by students is because the use of apps for language learning is not only effective but also fun: many apps come together with a smattering of gamification, rewarding students for accomplishing their goals, and encouraging them to keep up with their peers.

Social media, most notably Tencent's WeChat (微信), have also been playing a significant role in mobile learning in China. As China's most widely used instant messaging platform, with 768 million monthly active users at the end of 2016 (WeChat 2016), it was never designed to act as a Learning Management System (LMS). However, through a WeChat subscription account (微信订阅号), learning content providers can broadcast information to their followers. For example, the British Council posts English language learning content; Miracle Mandarin delivers Chinese language lessons; and Xueda Education distributes K12 subject tutoring materials through this channel. This social platform creates an organic way for

students to communicate with their teachers in one-on-one sessions or to collaborate with peers in webinars. It now appears that WeChat subscription accounts, as a learning platform, have succeeded where many traditional LMSs have failed: in promoting social interaction and taking education to where students already are.

To sum up, although mobile learning in China is still far from an integral part of K12 teaching and learning, it has already started to play an important role in improving access to education, as well as improving educational quality and efficiency. Students' favorable responses to learning apps, learning platforms, and social media confirm the positive impact of mobile learning. In light of such developments, the adoption of mobile learning will continue to grow.

Hong Kong by Yanjie Song (The Education University of Hong Kong)

Hong Kong SAR has one of the highest smartphone penetration rates in Asia. In 2015, 76.9% of 10–14 year olds, 97.9% of 15–24 year olds, and 98.8% of 25–34 year olds had access to smartphones (Census and Statistics Dept, HKSAR 2016). Most users spend more time using their smartphones than any other Internet-enabled devices for accessing information, using social networks, taking pictures, sending emails, and for entertainment anytime, anywhere (GO-Globe 2014).

Taking advantage of the high penetration rate of smartphones in Hong Kong, the government provides more than 100 mobile apps covering different kinds of services (GovHK 2017). Beyond Campus is one of the popular educational mobile apps designed and developed by the Education Bureau (EDB) of Hong Kong. It allows teachers to design their own mobile activities for outdoor learning, using the Global Positioning System (GPS) to display routes and tasks. Another large-scale EDB-supported e-learning venture that includes mobile learning practices has been initiated in 100 schools; it includes the development of curriculum-based e-textbooks aimed at fostering students' twenty-first-century skills. These schools have acquired sufficient mobile devices and have Wi-Fi access in all classrooms for using e-textbooks and e-learning resources.

In addition, universities in Hong Kong are conducting studies on developing apps to support school education, such as EduVenture and LearningVillages. EduVenture is a context-aware mobile learning system developed by the Chinese University of Hong Kong, which supports teachers and students in conducting outdoor field trip learning activities (Jong and Tsai 2016). Students' learning trails can be documented in the learning system. Supported by the built-in GPS system on mobile devices (such as iPads), learning tasks in a certain location are triggered when students walk through the physical target area. LearningVillages is an integrated mobile learning system operating in the form of a Massively Multiplayer Online Role-Playing Game (MMORPG) (Jong 2014); each virtual learning village represents an issue of inquiry to facilitate students' engagement in outdoor inquiry-based learning in social sciences and humanities education.

In addition to developing mobile apps, studies on mobile and seamless learning pedagogical design and practices are prevalent in Hong Kong. Various existing

mobile apps have been integrated into pedagogical designs to support students' learning anytime, anywhere. For example, a series of studies on inquiry-based learning have been conducted in Hong Kong schools, employing mobile apps like Skitch (annotation app), Evernote (note-taking app), and Edmodo (a social networking platform) to support students' science and mathematics inquiries across multiple spaces (e.g., Song 2016). Innovative pedagogical designs have been tested, such as the integration of a Bring Your Own Device (BYOD) model into inquiry-based collaborative learning (Song 2014), and a "productive failure-based flipped classroom" pedagogical approach to support students' learning in a mobile learning environment (Song and Kapur 2017), which are effective in motivating students to learn and develop problem-solving skills.

To increase teachers' capacity in implementing e-learning, the EDB has developed a community of practice among teachers to share best practices and encourage collaborations between schools to renew the curriculum and transform pedagogical practices (EDB 2014). The EDB is continuing to enhance IT infrastructure, including providing Wi-Fi access in all public-sector schools since 2014 and building school professional leadership and capacity to foster ubiquitous learning in school education in Hong Kong.

India by Aji Divakar (Murdoch University)

With more than 1.51 million schools and a student population of over 254 million (MHRD 2016), India has one of the largest education systems in the world. With more than one billion mobile phone subscribers, of whom 20% are smartphone users, India is also one of the fastest growing nations in digital consumption (Rai 2016). As India is expected to overtake China in population by 2022 (UN 2015b), growth in the number of mobile technology users can be taken for granted. The Digital India initiative from the national government has not only secured supporters in Silicon Valley but has also acclimatized the nation for educational technology incubation. Recent investments in a learning content provider, Byju's, by Facebook and Sequoia Capital has led to high hopes for technology startups in the K12 market in India. With more than five million downloads, Byju's is a clear example of a success story to emerge from the Indian educational technology sector.

The Ministry of Human Resource Development (MHRD) has launched apps like ePathshala to make textbooks available online for students. The government has also launched digital initiatives like Saransh, a platform to unify data on student performances from schools across the states. In a diverse nation like India, where schools may operate under central or state examination boards, students can choose a local language or English as a medium of study. With policy differences among states, technology can be a unifying solution if it can manage these diversity challenges. Learning and teaching in the Indian education system is mainly about preparing students for various board examinations. That trend is also reflected in subscriptions to mobile learning applications among students in India, with examination-oriented apps like Meritnation and myCBSEguide being popular.

India stands to gain a great deal from ICT innovations related to ubiquitous learning environments (Kinshuk and Huang 2015), which could offer appropriate educational solutions in this massive country. On the hardware side, the manufacturer Datawind, which has local offices in India, entered the market with a $35 tablet and has become the market leader in affordable tablets in India. In a country where one in five is poor (Narayan and Murgai 2016), but 61% of the poor own a mobile phone, if advancement in mobile learning is coupled with impact investing (Cronin 2017), there is considerable hope for education in India. However, the lack of academic research on these issues in India remains a concern.

Indonesia by Linawati (Udayana University)

A survey by Indonesia's Internet Operator Association in 2016 showed that around half of the population has some form of Internet access. Most people use a mobile device, such as a smartphone, for this purpose (Widiartanto 2016). In 2014, 64.7% of senior high school students were using the Internet, while 2 years later, in 2016, this had increased to 69.8% (compared to 89.7% of university students who were Internet users) (MoCI 2016). Digital marketing research organization eMarketer speculates that in 2018 the total number of smartphone users in Indonesia will exceed 100 million. This could make Indonesia the fourth largest smartphone market in the world, after China, India, and the USA. At the same time, Indonesia is a leader in the adoption of Facebook via mobile devices (Noviandari 2015). In addition to social networking, messaging and web search activities have been widely adopted by mobile technology users in Indonesia (Auliani 2015).

There have been a number of initiatives in Indonesia that relate to ICTs in education and mobile learning. The Indonesian Government's Computer-Based National Exam initiative has been attempting to implement a technology-supported assessment strategy since 2013 (Pakpahan 2016). However, only 42 junior high schools, 135 senior high schools, and 379 vocational high schools have adopted this strategy. Taking into consideration the fact that Indonesia has 26,380 senior secondary schools, the 135 schools that have adopted this strategy represent a tiny minority. In simple terms, most Indonesian schools have to develop a suitable technology infrastructure and capacity to embrace such an initiative (MoEC 2016). Furthermore, the Ministry of Education and Culture (MoEC) has introduced an initiative to regulate and support the implementation of online learning (Abidin et al. 2015). There were previous attempts to integrate online learning technology in teaching and learning in Indonesia. For example, in 2007, the MoEC launched the Jardiknas National Education Network project with the aim of connecting senior high schools in a network of educational innovation and online learning (Yuliani 2010). However, the project was later suspended, due to what some suggest are political reasons.

More specifically with regard to mobile technology, the MoEC has developed the e-Sabak application that runs on tablets and offers access to e-textbooks for schools (Husada 2015; Mahardy 2015). The e-Sabak project provides more than 1,300 e-books which can be accessed through a dedicated app available for download

via iTunes or Google Play. At the same time, the Ministry of Research, Technology and Higher Education has established a number of open Moodle-based courses since 2014 (MoRTHE 2017). Furthermore, other mobile learning applications have been developed by universities with the assistance of government research funding, or in rare cases by private companies such as Kalese (Husada 2015).

A number of interesting studies on mobile learning have been conducted in Indonesia, including studies relating to mathematics (Abidin et al. 2015; Tifani et al. 2016), language learning (Darmanto and Hermawan 2016; Seangly et al. 2016; Susanti and Tarmuji 2016; Ulfa 2013), media studies (Astra et al. 2015; Sulisworo and Toifur 2016), and students' learning strategies with mobile technologies (Sulisworo 2017). These studies largely focus on the obstacles to the implementation of mobile learning in Indonesia. One obstacle that stands out is that the majority of schools prohibit the use of mobile devices in the classroom due to concerns over inappropriate uses by students, negative effects on students' mental health, and possible disturbances to students' learning. On a positive note, some studies have explored ways for Indonesia to become one of the pioneers in the field of mobile learning (Padmo et al. 2015).

Mobile learning in Indonesia can offer many opportunities to improve education quality. Mobile technology penetration in Indonesia is high, and it is continually increasing. Furthermore, emerging findings from international and local researchers, and experiences from implementations in other countries, are likely to encourage mobile learning adoption in Indonesia. However, the implementation needs strong backing from the government to overcome existing obstacles and provide support in areas such as access to electricity; the development of telecommunications and Internet infrastructure across the vast territories of the country; and encouragement to stakeholders to support mobile initiatives. Finally, it must be noted that the implementation faces challenges related to perceived ethical concerns and school regulations.

Japan by Eric Charles Hawkinson (The University of Fukuchiyama)

The timing of Japan's economic bubble and its rise to technological mastery at the end of the twentieth century set the tone, for better or worse, for the current state of mobile technology development and use. Japan saw rapid and widespread use of mobile technology from the 1990s. In 2002, over 40% of the population was in possession of an Internet-connected mobile device (Ishii 2003). When the iPhone came to Japan in 2008, it did not take too long before Japanese developers flooded the market with mobile applications as the market was ripe and ready for mobile purchases, so that iOS application revenue from Japan ranked second in 2012 (Arthur 2012).

Unfortunately, this wide-scale adoption of mobile technology has not made its way into public education to the same extent. Regulations and policies from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) have prioritized student privacy over free use of mobile phones in schools (MEXT

2015). This has left an opportunity for the private sector to fill the needs of learners. The Japan Massive Open Online Education Promotion Council (JMOOC) started an online learning platform in 2013 that has become a large collection of learning content in Japanese (Yamada 2015). SoftBank's Cyber University is an interesting attempt to harness learning content for mobile phones by one of the largest communication network carriers in Japan (Zhang 2008). Other companies have sought to bring educational content to the Nintendo 3DS and other similar game systems, as they still have high market adoption among young Japanese. Software development companies have licensed textbook content and created supplementary resources for mobile Nintendo devices, including *New Horizons*, an English language textbook used by most Japanese middle schools. Japan's cram-school industry has also been much more open to mobile learning than public schools.

The combination of the timing of technological advancement with other cultural phenomena in Japan has produced a strange paradox of high tech environments, but radically traditional thinking. This "Galápagos Effect" (ガラパゴス化) has had a profound impact of the development of mobile learning in Japan. The clearest example is the extended use of flip phones in Japan. These phones required a specific design of webpages with minimal graphical content and a need for only a little bandwidth. This still has an influence on web design today in Japan (Hawkinson 2017). It has, in a way, put Japan at a disadvantage compared to other Asian countries, because it can be harder to update all users and technology, especially in respect to behavior, rather than starting from zero.

There are some interesting things in store in Japan. There are still a very large number of developers and technology companies looking to fill the needs of learners, mostly in informal learning environments. One promising development is the use of augmented reality (AR) and virtual reality (VR). There are many fascinating projects, and there is accompanying research going on into these technologies for learning. It remains to be seen if they can overcome societal and policy barriers to be implemented at larger scales in Japanese schools (Hawkinson et al. 2017).

Laos by Phonekeo Chanthamaly (National University of Laos)

In recent years, Laos has been adopting 3G and 4G technologies, and the Internet user base has grown impressively from 6,000 in the year 2000 to 1.4 million in the year 2016, constituting about 20% of the total population (Internet World Stats 2016a). However, the cost of Internet access remains relatively high compared to the average income, and most people still cannot afford it easily. Those who use the Internet in Laos are predominantly young people in the city areas and/or people from high income families. The cost of Internet access has seriously affected schools, and many are struggling to secure any funding for this. The Ministry of Education and Sports (MOES) has its national master plan that addresses some of the critical issues. However, the nature of the support for ICT integration is not entirely clear.

All teaching and learning in schools in Laos is conducted in a traditional face-to-face mode, and until now there has not been any additional e-learning adoption.

From 2010 to 2015, the Laos Government, through the MOES, launched a project to support and extend educational opportunities across the country, piloting it in 17 provincial secondary schools, and enabling these schools to set up ICT centers with equipment provided. However, the strategy has been seriously constrained due to a lack of Internet access, a lack of e-content, and the overloading of teachers with regular teaching and administrative duties. At the same time, private companies specializing in ICTs in education and equipped to effectively support schools are almost nonexistent in Laos.

Until the present time, little data on K12 school students' use of ICTs for their education have been available in Laos. However, in 2010, the IT Centre at the National University of Laos implemented a study of the use of digital technologies in higher education institutions in Laos, and the results showed that only 39% of students owned notebooks. The majority of students were accessing the Internet in Internet cafés, not through computers at home or at their institutions. Nevertheless, since the introduction of 3G to Laos in 2012, many students, especially in the capital, Vientiane, have been using smartphones to access the Internet. Thus, smartphones are a primary means of accessing the Internet for learning, but as yet there are no institutions in Laos providing full e-learning or m-learning systems.

Macau by Christopher Fulton and Spencer Benson (University of Macau)

Here we describe the current state of mobile learning in K12 schools in Macao SAR. Our focus is on case studies of teachers working in a limited number of schools from the pool of 77 K12 schools in Macao (DSEJ 2015). The K12 school system in Macao is unique in that the majority of the schools are private, the primary language of instruction can be Portuguese, Putonghua, Cantonese, or English, and there is no government-mandated curriculum per se. A survey of school websites in Macao and conversations with teachers have revealed that the integration of mobile devices and computers into classroom activities is occurring in a limited number of schools. In our 2017 survey, only seven schools were identified as having established classroom environments in which laptops or tablet devices are used by students on a daily or weekly basis. Two Chinese-medium private schools have implemented a one-to-one laptop or tablet initiative. Other private schools are experimenting with laptops and tablet devices.

A one-to-one mobile learning initiative that was implemented at St. Paul's School (one of the larger K12 schools in Macao) in 2012 has been chronicled in the press (Lam 2012) and in a case study (Garcia et al. 2014). The initiative sought to change teachers' pedagogy from primarily didactic and transmission-based teaching to a form that was more collaborative and to increase student motivation and interest. One of the major changes involved replacing textbooks with touchscreen tablet computers (Lam 2012). However, the change from textbooks to laptops can be challenging for teachers, who often struggle to find time to prepare content and interactive activities for learners that capitalize on the devices' affordances. Garcia

et al. (2014) listed potential issues with the school-wide mobile learning initiative and its impact on St. Paul's School's mission statement.

An issue of primary importance is the need to communicate to parents the purposes and advantages of mobile learning and the benefits of implementing an ICT initiative with a Learning Management System (LMS). LMSs allow schools to disseminate and document student learning activities and enable communications among stakeholders. When teachers use an LMS, learning activities can be better monitored and assessed. However, features, capabilities, and affordances of laptops, mobile devices, IT infrastructure and, most importantly, the LMS, all shape and influence pedagogies that are implemented within an institution's classrooms. Learning activities using LMSs, often during class time, involve students accessing the LMS and learning activities via tablet devices, laptops, or Chromebooks; this allows for students to construct, write, and share ideas online. To create opportunities for social learning among young students, schools in Macao have experimented with Moodle, Edmodo, iClass, and DyKnow.

The development, setting up, and deployment of innovative learning activities using LMSs is generally perceived by teachers and students as time-consuming. For many teachers, a potential risk of conducting learning activities with mobile devices and networks is the feeling that the time is not used efficiently, while pedagogical objectives do not align with the technology available to teachers and students. These can be major obstacles to mobile learning integration. Moreover, conversations with school teachers in the surveyed Macao schools suggest that the support provided by IT departments often does not meet their needs. Additionally, the cost of the LMS is seen as an obstacle.

The types of mobile devices (e.g., iPads, tablets, Chromebooks, or laptops) that are supported and employed vary among the schools. For instance, the majority of teachers at one private school were allocated a touchscreen laptop with the Windows operating system, and at another school, teachers were able to choose, with a preference for Apple laptops. Conversations with teachers overseeing IT systems at the latter private school indicated that low-cost, portable devices such as Chromebooks, which have limited functions and can only display content in a web browser, were also used by teachers and students. The hidden costs of supporting multiple types of mobile devices, for example, laptops and tablets, and the practical issues of training teachers using those devices, have to be evaluated before implementation of any mobile learning initiative.

This limited exploration of Macao K12 teachers' practices indicates that, to a large degree, Macao schools are not capitalizing on the use of the most ubiquitous mobile device, i.e., smartphones, and thus the greatest opportunity for mobile learning is overlooked. Moreover, in nearly all K12 schools, smartphones are banned. One primary Macau teacher, from a school with a one-to-one tablet program, predicted that eventually students would be able to use their own smartphones at school as long as the smartphones met certain requirements. For instance, each phone would need to be registered and have an application installed to give schools or parents control over the smartphone. In Macao, like many other places, the learning potential in smartphones is not capitalized upon. This is a missed

opportunity for young learners to gain experience and guidance at school on how to use their smartphones as devices that can augment and enhance their learning experiences, in and out of the classroom.

Malaysia by Rozinah Jamaludin (Universiti Sains Malaysi)

Malaysia has developed the Learning Beyond Boundaries concept, launched recently by the Ministry of Education (MOE). It is aligned with the Malaysia Education Blueprint 2013–2025, which incorporates ICTs in education under Shift 7 (involving leveraging ICTs to scale up quality learning across the country) (MOE 2013). This is in turn linked to the 1BestariNet project that aims to provide 4G Internet access and the Frog Learning Management System (LMS) to over 10,000 Malaysian schools. Teachers have reported that with use of the Frog LMS, both students' academic progress and their communication skills have improved (Chonghui 2016). Online assessments are marked straight away and students receive their marks and feedback immediately. The platform also motivates students to express their views and is thus helpful to more introverted students who are shy to ask questions.

For primary and secondary school students in Year 6 to Form 1 (aged 12–13 years old), Scratch, a free programming language, has been introduced. In Form 4 (where students are 16 years old), they are introduced to the Windows Operating System, Microsoft Office, StarOffice, Microsoft Visual Basic, HTML, Java, JavaScript, Microsoft Access, WAMP-PHP, MySQL, and XAMPP, and they are encouraged to develop multimedia applications (Penang Education Department, personal communication). Web 2.0 tools such as Kahoot!, Padlet, and TodaysMeet, along with green screen technology, have been introduced to students in primary and secondary schools. This has also exposed students to game-based learning and introduced gamification into teaching and learning, as in Kahoot!, for example.

Some private schools such as Cempaka Schools Malaysia have been among the first Apple Distinguished Schools (ADS) in South Asia, as well as pioneers of the ground-breaking LMS Schoology in the Asia Pacific region. Since 2009, Cempaka Schools have been the leading schools in Malaysia to use a one-to-one learning environment where each secondary student has a laptop. Other international schools such as Nexus International School and Garden International School are accredited as ADS. Fairview International School in Penang introduces the use of iPads to children aged 5–7 years as a medium through which to learn about the world around them. Students from Grade 3 (7–9 years) in the International Baccalaureate program showcase to parents the use of iPads in school. Some fully residential schools funded by the government, like the Malay College Kuala Kangsar and Tunku Kurshiah College, also have a strong commitment to one-to-one iPad programs.

It should be noted, however, that because of issues such as discipline problems and disturbances during lessons due to the presence of mobile phones in schools, the MOE, under circular policy 2/2009, prohibited all students from bringing mobile phones into the classroom (Office of Director-General of Education Malaysia 2009).

The future of Malaysian education will involve online learning or blended learning as part of teaching and learning. Currently, learning with school-approved devices is seen as potentially the best way to maximize the use of ICTs for distance and self-paced learning, regardless of location or student skill level. Although there are some challenges faced by schools, like unstable connectivity, they must be resolved as quickly as possible if Malaysia is to move ICTs into the classroom to support twenty-first-century education (Soon 2014).

Myanmar by Thazin Lwin (Yangon University of Distance Education)

The Myanmar Government aims to enable every individual to acquire basic education. In order to meet the Millennium Development Goals (UN 2015a) and ensure full access to quality primary education in Myanmar, there is a high demand for government expenditure on education, training and recruitment of teachers, better education standards, and increasing the number of schools and their facilities. Education is essential to end poverty in Myanmar. Many young people in developing countries, particularly girls, continue to lack access to education. Myanmar has laid down a policy of compulsory primary education with the aim of achieving 100% enrolment (Kyaw 2013). However, there are many challenges for Myanmar to improve its education. The average adult in Myanmar has received just 2.8 years of schooling, and only 36.5% of students who are eligible for secondary education actually enroll (Arohana Scholarships 2013). Today, two-thirds to three-quarters of children drop out of elementary school before Grade 5. It is foreseen that ICTs, including mobile learning, can significantly improve access to education across the country.

Only few years ago, less than 2% of the population in Myanmar had access to the Internet. Today ICTs are at the center of discussions related to education reforms in Myanmar. UNESCO is working with the Myanmar Ministry of Education (MOE) to support adoption of ICTs in schools. Since early 2015, UNESCO and the MOE have been implementing a multistep program to support ICTs in education, focusing on development of qualified teacher educators to lead the integration of ICTs into preservice programs, connecting schools to mobile broadband networks, and allowing teachers and students to benefit from access to twenty-first-century learning and applications (UNESCO 2015a). Through this UNESCO initiative, selected schools were provided with ICTs such as laptop computers, tablet computers, and projectors and support to enable teachers to best utilize this technology in the classroom.

Recently, mobile technology in education initiatives has begun to emerge in Myanmar; for example, UNESCO, Ericsson, the MOE, and other partners are collaborating on the Connect to Learn project with the aim of improving learning outcomes in literacy and numeracy via the use of mobile technology. Some 33% of households in Myanmar have mobile phones and many of them use mobile phones to access the Internet (UNESCO 2015b). This represents a starting point to explore the use of mobile technology in improving the quality of education. Yet there is still a

need for more projects to promote mobile technology for learning. Mobile learning should serve as another important milestone for the MOE in the education reform process. UNESCO is continuing to support Myanmar as it enters the world of smartphones and Internet access, aiming for greatly increased mobile penetration rates in the near future to bring it into line with neighboring countries (UNESCO Bangkok 2015).

The Philippines by Melissa Orencia (Philippine Normal University)

The Philippines is a rapidly growing smartphone market in Southeast Asia, with 20% year-on-year growth (IDC 2016). The upsurge is attributed to the emergence of locally produced, cheap, low-end smartphones accessible to low-income Filipinos. Smartphone penetration is expected to rise to 70% in 2018 from 40% penetration in 2015 (Camus 2015). In June 2016, Internet usage in the Philippines involved 52% of the total population (Internet World Stats 2016b). The majority of Filipinos use mobile phones to go online, and they commonly engage with social media platforms like Facebook and Twitter, watch digital videos, play games, engage in location-based search, and shop online. However, low connectivity, the necessity for higher memory capacity, and the cost of Internet access are challenges that must be addressed (Medenilla 2016). The Philippine Government established the Department of Information and Communications Technology (DICT), which crafted the National Broadband Program to ensure that problems of access and speed are tackled and to guarantee faster and wider Internet connectivity (CNN Philippines 2017; DICT n.d.-b; Telco.Ph 2016).

Teachers' continuing professional development, fast and reliable Internet connections, and regular updating of technology infrastructure characterize the private schools. Xavier School (XS) and De La Sale Santiago Zobel (DLSZ) are pioneers in effective K12 adoption of mobile technologies. Within a one-to-one device-to-student approach, mobile devices are used to promote personalized and authentic, experiential learning, making students more engaged, productive, and responsive. In XS, for instance, students engage in photo-blogging, podcasting, audio-recording, and v-logging in different subject areas. They use Puppet Pals and Toontastic apps for storytelling, Idea Sketch, and Mindomo to generate ideas and connections, Socrative and Nearpod for literature classes, and FaceTime for communication (Lee-Chua 2013a, b). In science, students create and extend their learning through virtual experiences, enrichment, and interactions via LMSs like McGraw-Hill's CINCH Learning (Bernabe 2013). In Science, Technology, Engineering and Maths (STEM) subjects, students explore experiences enhanced by mobile devices using 7D Experience, robotics, visual programming with Sphero, and 3D printing (Demegillo 2017). In DLSZ, teachers are even creating iTunes U courses to promote learning of science concepts (National Teachers' Month 2016).

In poor and marginalized public school contexts, learning resources tend to be scarce. Access to high-end mobile devices, Internet connections, and teachers' competence in applying mobile learning are generally inadequate. To address this,

the government has initiated partnerships with the private sector. Text2Teach is the government's longest-running joint project with the private sector to date. The Department of Education (DepEd), Ayala Foundation, Nokia, Globe Telecom, Pearson Foundation, Toshiba, and Microsoft, along with local government units, are collaborating on the local implementation of the Global Bridge IT program conceptualized in 2003 by Nokia, Pearson, the United Nations Development Programme and the International Youth Foundation (Cristano 2014). Rich digitized teaching resources are delivered through mobile technologies, which has improved the quality of education in at least some far-flung and under-served public schools.

The University of the Philippines Open University (UPOU) has spearheaded mobile learning initiatives in both formal and nonformal education settings. In 2003, the UPOU implemented the TXT 700UPOU mobile learning program involving SMS-based mobile courses for English, maths, and science (Librero et al. 2007; Pena-Bandalaria 2007; Valk et al. 2010). Then the UPOU partnered with the Molave Development Foundation and the DepEd's Alternative Learning Services and received research funding from the International Development Research Center in 2005–2008 for the Project MIND to train learners in English and mathematics in the nonformal education context (Ramos et al. 2007). In 2013, the Abot-Alam program, through the DepEd and the Technical Education and Skills Development Authority, involved collaboration with mobile operators using mobile-enabled learning services to reach out-of-school youths. In 2013, the UPOU investigated the impact of using tablet computers in selected public secondary schools with support from the Australian Agency for International Development (AusAID) (Australian Embassy 2013). The study revealed that teacher training and access to mobile devices affects learning improvement (UPOU Trailblazers 2015).

Specific policies and laws support mobile learning. The e-Government Master Plan 3.0 (eGMP 3.0) emphasizes strengthening of educational reforms (MITHI n.d.). The Philippine Digital Strategy 2011–2016 encourages public-private sector education stakeholders' exploration of mobile technologies for education (DICT n.d.-a). The DepEd ICT4E Strategic Plan supports new modes of delivering education including mobile learning (DepEd 2008). The Republic Act 10650, or the Open Distance Learning Act, identifies mobile learning as a mode of delivery for distance learning (Congress of the Philippines 2014).

The development of mobile apps has grown steadily in higher education in recent years. For instance, Cheng (2003) designed a framework for mobile learning development; Santos et al. (2010) created an augmented reality system for situated vocabulary learning; Red et al. (2013) developed Word Infection, a game-based app to learn about synonyms, antonyms, and homonyms; Odilao and Bautista (2014) used mobile learning devices for early interventions with children with an Autism Spectrum Disorder; Tuliao et al. (2015) created iSuro, a kindergarten tool for teaching and learning aligned with the K12 curriculum; and Monzon et al. (2016) designed Maestra for beginning readers in Filipino. The increasing development of mobile apps provides much potential for enhancing learning and improving the overall quality of education.

Singapore by Kumaran Rajaram (Nanyang Technological University)

A recent Deloitte Technology, Media and Telecommunications survey revealed that Singapore has the highest smartphone penetration rate in the world; nine out of ten respondents had access to a smartphone (Today 2015). Some 98% of households with children who are enrolled in preuniversity education have access to the Internet (IMDA 2014).

Mobile technologies in Singapore have superseded their fundamental functions such as communications, entertainment, and social networking and have now extended their affordances into educational settings. The well laid-out infrastructure and easy accessibility of mobile technologies make the integration of mobile devices into classroom learning designs at schools seamless. Global startups such as Quipper, SkillPixels, and Duolingo are developing applications and bringing mobile learning to classrooms across the region. SmartKid, an iOS game to teach maths for preschool, Grade 1 and 2 learners, emerges on the top 10 download lists in Singapore and other markets in the Asian region. The partnership of Singapore-based Marshall Cavendish Education with the award-winning mobile game developer Kenneth Tan produced Brainy Arkies, a mobile game designed based on the latest Singapore Ministry of Education (MOE) syllabus to supplement mathematics learning for primary school students.

Back in the 1980s, Singapore initiated the School Link Project for computers in schools (Koh and Lee 2008a). The Professional Computing Support Program commenced in the 1990s to develop teachers' IT skills. The MOE has launched four Masterplans for integrating ICTs into teaching practices and learning experiences in schools, covering the years 1997–2002, 2003–2008, 2009–2014, and 2015–2020, respectively. Masterplan 4 is an ongoing project that focuses on quality learning and aims to develop "Future-ready and Responsible Digital Learners" (MOE n.d.). FutureSchools@Singapore, a government-led initiative, endeavors to enhance the diversity of educational offerings to cater to learners' needs and integrate technology into the delivery of materials. The strategic partnership with infocomm industries has resulted in many new tools and applications that have transformed experiences, for both teachers and students. Notable examples include the augmented reality mobile learning trails developed by companies such as LDR and Rockmoon and deployed in many schools as well as tertiary institutions, with teachers and even students now designing their own app-based multimedia mobile learning activities (Pegrum 2016c).

Research and development (R&D) plays a crucial role in Singapore's endeavors to promote itself as a global education hub, explicitly integrating ICTs in learning. Several explorative pilot studies were conducted by the MOE in primary and secondary schools and junior colleges in the mid-1990s to comprehend the adoption of ICTs in education. These served as the basis for the development of the ICT Masterplans (Koh and Lee 2008a). The eduPAD project was launched in 1999 by the MOE and its industry partners in collaboration (Koh and Lee 2008b). In 2003, Microsoft Singapore and the Infocomm Development Authority of Singapore, with support from the MOE and the National Institute of Education (NIE), launched the

collaborative project BackPack.NET, in which tablet-based applications were developed and tablets were deployed to secondary schools to study the potential of ICTs in education. One of the highlights of this project is the Classroom of the Future Live! (COTF Live!) that showcases applications of new technologies in everyday teaching and learning, set up at NIE in 2005. The BackPack.NET center was also launched, serving as a research and training center to integrate ICTs into education (Koh and Lee 2008b). Other R&D initiatives include FutureSchools@Singapore, LEAD ICT@Schools, Edulab, and the Learning Sciences Lab at NIE.

Continuous advancement and prevalence of mobile technologies is evident in Singapore, thanks to wide-ranging governmental support backed up with reliable technological infrastructure. The possible challenges include the sustainability of mobile learning projects. It is hoped that involvement by other stakeholders – such as industry leaders in mobile learning, parents who have the purchasing power, and educational institutions that embrace the ecosystem of mobile learning – will create a smooth pathway for sustainable development.

South Korea by Michael Gallagher (The University of Edinburgh)

The technological infrastructure of South Korea, driven by massive government infrastructural investments of the late 1990s (Frieden 2005) and a thriving domestic mobile industry, underpins many of the mobile learning developments taking place in the country today. Some 97.5% of all households in Korea have broadband access (OECD 2016); there are 56.9 million mobile connections for a population of 50.4 million people (GSMA Intelligence 2015), and 99% of the population enjoys mobile broadband connections.

As a result, mobile traffic accounts for 37% of all web traffic in South Korea (We Are Social 2017). A total of 87% of the South Korean population actively uses social media, and 83% of that population is doing so through mobile as of 2017. Along with this connectivity comes a local capacity for digital software, applications, and social media environments; South Koreans are accustomed to using technologies and applications developed in and for South Koreans, from earlier social media (CyWorld, or 싸이월) to modern messaging applications (KakaoTalk, or 카카오톡), all accessed through domestic mobile technology (Samsung, LG, and more). Further, they use mobile at an early age, with 80.6% of Korean adolescents having their own mobile phone and, for example, 87.7% of 12-year-old Korean adolescents using mobile phones, far more than in other countries (Ok 2011, p. 330). These numbers have surely increased since 2011, and data collection has extended further into younger demographics as Internet use is measured to include children as young as three (Harpur 2017).

Korean students in primary and secondary education are using mobile technology in predictable ways: to reinforce a local sociality and maintain peer relationships, to reference or research, to take notes, to create and consume media, and more. They do this largely through domestic applications, such as KakaoTalk, in such a way that it reinforces the cultural landscapes in which these students find themselves. Jin and

Yoon (2016) write: "the KakaoTalk-scape does not simply signify a radical rupture from young people's ordinary cultural landscape but rather implies the possibility that smartphone technology is incorporated into the rhythm of young people's everyday lives" (p. 520). These students, through their use of KakaoTalk, are reinforcing in the digital space the Korean environment they see in their daily lives through chats, texts, emoticons, and media.

This extends into social media with some slight idiosyncrasies: Korean social networks tend to be much smaller than their Western counterparts and people's motivations for participation (social support, some information seeking, less casual relationships) speak to a close-knit social network that reinforces peer communities (Ok 2011). Social media, like mobile technology, "reconfirm young people's peer networks, which continue traditional modes of sociality and cultural identity rather than encroach on them (Na 2001)" (Ok 2011, p. 329). KakaoTalk continues the trend advanced in earlier Korean social networks, such as Cyworld (Hjorth 2007).

For education, this saturation of access and mobile technology has produced an environment where mobile learning is part of a larger interrelated whole. Smart learning involves "learning with resources and content available from both the public and private sector, including social learning as found through social media," and "technology-embedded learning where technology is available to support anytime, anywhere learning" (Noh et al. 2011; translation by author). Mobile learning initiatives for primary and secondary education reflect this, such as the South Korean government's USD 2.4 billion effort to digitize all educational materials by 2015, making them accessible through computers, tablets and smartphones (Pandit et al. 2012).

Research, however, on the effects of mobile learning is sparse and speaks to quantitative measures of acceptance and willingness to use mobile technology in K12 classrooms, rather than to learning impact. Considerable research exists in the informal mobile learning space of social media use and KakaoTalk (Hjorth 2007; Jin and Yoon 2016), but rarely is that bridged with formal learning in the K12 classroom. Some recent examples provide optimism for renewed interest in impact, such as Bae and Lee's (2016) discussion of a mobile learning application for creative problem solving activities, but this research is limited in the larger body of mobile learning in Korea.

The use of mobile technology for formal learning will garner more attention and resources as Korea's mobile industries continue to thrive and greater amounts of Koreans' sociality is enacted in mobile spaces. Whether that transfers into research demonstrating the impact of mobile learning in formal education remains to be seen.

Taiwan by Chun-Yen Chang (National Taiwan Normal University)

There is an increasing prevalence of Internet usage in Taiwan (Internet World Stats 2017). Taiwan's Internet users accounted for 88% of the total population in March 2017, as opposed to 67.4% in 2008. A survey of students' Internet usage conducted by the Taiwanese Ministry of Education (MOE) in 2015 revealed that the

percentages of students who possess their own smartphone devices include: 38.8% of elementary school students, 78.8% of junior high school students, and 93.3% of senior high school students (MOE 2015). In addition, the average time spent on the Internet per school day for these groups of students is: 45.1 min, 67.1 min, and 75.2 min, respectively, and 57.8 min, 115.8 min, and 147.2 min on the weekends. These statistics reveal that Taiwanese students, in general, spend a great deal of time surfing the Internet.

In response to global trends in information technology and mobile technology development, tablets and smartphones have gained increasing popularity. The MOE has developed the Teachers' Teaching Application, which provides a platform for in-service teachers to share their innovative experiences and feedback about mobile teaching. The application has so far received more than 2 million hits, provided 700 varied teaching examples, and compiled a list of about 1500 teaching applications screened and recommended by teachers around the country. In addition, the MOE has taken the initiative of encouraging collaborations between the academic community, county and city governments, and the private sector. Examples of their efforts include the 2014–2016 Taiwan Mobile Learning for High Schools (http://mlearning.ntust.edu.tw/) and the 2014–2017 Mobile Learning for Elementary and Junior High Schools (http://mlearning.ntue.edu.tw/) projects. The purpose of these projects has been to encourage schools to actively integrate information technology and digital resources into teaching, and develop student-centered innovative instruction. In doing so, it is hoped to enhance students' domain knowledge and to help them develop important skills, such as communication, critical and innovative thinking, problem-solving, collaborative learning, and the like.

Higher education institutions in Taiwan are also actively developing new mobile technology systems to facilitate teaching and learning. The National Taiwan Normal University (NTNU), for example, has developed its mobile application CloudClassroom (CCR) to enable students to give feedback or responses to instructors' questions in real classroom settings in an instantaneous manner on a mass scale. CCR is written in HTML 5.0 and, without additional software or plug-in installations, it works on every mobile device such as laptops, PDAs, smartphones, and tablets. Once connected to CCR through their own mobile devices, the instructors can pose various types of questions to the entire class. Students are then able to use their devices to give responses to the instructors in the form of digits, texts, pictures, animations, or even multimedia. Since there is no pressure for the students to speak out their answers or to raise their hands when volunteering to speak, it creates a safer and more comfortable learning environment for quiet students to participate in during the class. On the other hand, verbal students' needs for interacting with teachers and peers may be met as well. Furthermore, CCR can automatically aggregate a report for the teacher to gauge students' learning in a timely manner. The usability of CCR has been validated in science classrooms in Taiwan (Chien and Chang 2015; Chien et al. 2015). Having developed this efficient mobile teaching and learning system, NTNU has made great efforts to share the system with primary and secondary school teachers and provide workshops and teacher training to assist them in making good use of the system to facilitate their teaching. At present,

approximately 15,000 users have been registered in CCR. More than 120,000 classroom activities have been conducted by using CCR. It is anticipated that CCR will become more cost-effective as more and more schools start embracing Bring Your Own Device policies.

As wireless communications and mobile technologies continue to advance and gain popularity, increasing numbers of institutions are taking active roles in incorporating mobile technologies into educational settings, such as classrooms, museums, and labs, to enhance students' learning motivation and achievements. While it is important that schools and educators keep pace with the times by employing effective educational technologies in teaching, it is also essential to be reminded that technology, by itself, does not improve teaching and learning. It is only by taking into consideration learners' needs and implementing careful learning designs and effective teaching strategies, that educators can use innovative technologies to truly facilitate and enhance teaching and learning as a whole.

Thailand by Vorasuang Duangchinda (Sripatum University)

Thailand is a fast-growing country with a population of over 68 million (Worldometers 2017). According to Veedvil (2016), there were 83 million mobile phone subscriptions in Thailand at the end of 2015, but only 4.3 million of them connected to a 4G network. However, the number of mobile subscriptions had increased to 90.94 million by January 2017, representing 133% of the population (Kemp 2017). A mobile phone of any type is the most common digital device, used by 96% of Thai adults, with some 70% using a smartphone, 26% a laptop or desktop computer, and 11% a tablet; most web traffic in Thailand is generated via mobile phones (66%), followed by laptops/desktops (29%), and tablets (5%) (Kemp 2017). Kemp (2017) indicates that 62% of the Thai population is active in using mobile social media, which is well above both the global and the regional average. Veedvil (2016) specifies that 74% of Thais use instant messaging every day, with smartphone users spending on average 94 min on communications and 62 min on apps, out of a total of 4.2 h per day spent on their smartphones.

Thailand is at a very early stage of adoption of smartphones in education. Currently, the predominant way of learning through technology in Thailand is by watching online teaching videos and searching for relevant information. However, the Royal Thai Government has introduced the Government Application Center (GAC), a centralized platform hosting freely downloadable mobile applications for all Thais (http://apps.go.th/). As of May 2017, there are 256 applications in 13 categories, including a dedicated section for education with more than 10 apps available. Each of the apps has been developed by a designated governmental department or a leading public university and serves a specific purpose, for example: "Thai Language Dictionary," "Digital Learning Television App," and "Museum Pool App." These applications can be utilized to support learning in K12 education.

For K12 education, overseen by the Office of the Basic Education Commission (OBEC) of the Ministry of Education, there is a dedicated portal called the "OBEC

Content Center," housing educational apps as well as authoring tools for K12 (http://contentcenter.obec.go.th/m/). In addition, there is a collection of K12 apps under the One Tablet Per Child (OTPC) project established in 2012. This ambitious national project aimed to provide a free tablet device with quality educational content to all K7 students. However, the project has now been suspended, and OTPC applications have not been developed any further.

Reform of education, at all levels, is much needed in Thailand. This reform should include not only an improvement of the government's strategic policies, but also strategic partnerships across public, private, and educational institutions. There has been strong support for such partnerships from international organizations including UNESCO. Examples of current initiatives promoting mobile learning in Thailand include Mobile Literacy for Out-of-School Children, a co-operative project between Microsoft, True Corporation, and the MOE (UNESCO Bangkok 2016); the Thailand Cyber University Project (http://www.thaicyberu.go.th); Thai Massive Open Online Courses (MOOC) (http://www.thaimooc.org); and Thai Open Educational Resources (OER) (http://oer.learn.in.th/). In addition, the government has been working very closely with universities around Thailand. A national project under the theme of "Teach less and learn more" saw universities voluntarily assisting the development of schools near their campuses.

Looking to the future, the national online education credit bank system is in the final stages of development, and the UniNet initiative has been successfully implemented to include dedicated high-speed fiber optic networks linking all higher education institutions throughout Thailand (Nasongkhla et al. 2015). High speed Internet connectivity, mobile devices, and the explosion of Artificial Intelligence (AI), Virtual Reality (VR), and Augmented Reality (AR) will shape Thailand's education in the near future. There is a strong need for research to examine the adoption of mobile and other technologies in education. Further research and development in AI, VR, and AR is also important to the advancement of the country under the Thailand 4.0 model (MOC 2016). Such technologies are likely to be integrated with mobile technologies, and thus together they will potentially shape the future of learning in Thailand.

Vietnam by Dang Hai Dang (Hanoi Open University)

In January 2016, internet penetration in Vietnam reached 50%, while the mobile phone subscriber base reached 152% of the population; among 35 million active social media users, there are 29 million active mobile social media users (Nguyễn 2016). With such growth in access, mobile technologies have a significant opportunity for adoption in K12 education in Vietnam.

In Vietnam, the K12 education system, with the total number of students exceeding 15 million, pursues rigorous academic goals. Its primary purpose is to equip students with the ability to attain a Secondary School Certificate (Grade 9) or Secondary School Diploma (Grade 12). All additional teaching and learning activities are adapted around the core curriculum designed to achieve such an end. This is

the case with the adoption of educational technologies that make these additional teaching and learning activities possible. In 2012, Vietnam's education authority issued Decision No. 711/QD-TTg approving the Education Development Strategy 2011–2020 (Nguyen 2012). In this decision, the government emphasized the important role of ICTs in building a learning society. However, the use of educational technologies in this strategy has been criticized for a lack of research, practical orientation, and quantitative indicators that show advancement in learning.

In the business sector, there are a number of innovative companies focusing on education, and these have been playing a critical role in spearheading the adoption of technologies in Vietnamese classrooms. Hocmai is the largest K12 online education provider with 2.5 million users. It provides both basic knowledge and exam preparation tests at competitive tuition rates. The learning content is mainly provided through media such as videos and slides accompanied by multiple-choice questions, notes, and discussions. However, the provider lacks interactive content and live or synchronous courses. Another platform is Rockit Online, which focuses on content and tests in mathematics, physics, chemistry, and English for Grades 7–12. Furthermore, there are large online test-taking and practice platforms including Violympic (for mathematics and science) and IOE (for English). Other platforms include the Monkey Junior mobile application for children from kindergarten to 10 years of age. In addition, there are companies like Topica and Kyna, interested in developing K12 mobile learning products in addition to their existing adult e-learning courses. The private sector, especially via startup companies, is likely to play an important role in the development of the mobile learning market. If the universities and educational research institutions in Vietnam remain in their current rigid mode of operation, they may well be left behind in these developments. Nonprofit organizations are less likely to join and contribute to these.

With the radical reform of the national education system in the near future, the core K12 curriculum will be designed in a more flexible and sustainable way. There has been a general focus on cross-curricular and life skills courses. It appears that there is a positive atmosphere for mobile learning to enter education, and in particular to support initiatives related to Science, Technology, Engineering and Maths (STEM), language learning, and life skills courses.

Discussion

While there are certainly differences in the mobile learning possibilities in the 17 locations covered in the country reports, a striking number of commonalities emerge. Key themes are outlined below. It should be noted that the broad distinction made between developed and developing countries in the following discussion is based on the countries which do, and do not, feature in the United Nations Human Development Index as having a very high level of human development; the countries in the study which fit within this category include Brunei, Hong Kong, Japan, Singapore, and South Korea (UNDP 2016); non-UN members generally included in this category are Macau and Taiwan ("List of countries" 2017).

Availability of Mobile Technologies for Learning

Thanks in large part to governmental infrastructural development over many years, developed locations in the Asian region have some of the world's highest rates of Internet penetration, mobile – especially smartphone – penetration, and mobile Internet penetration. Indeed, in many such locations, smartphones have become the usual way to access the Internet, with 3G/4G (and soon 5G) networks complemented by robust Wi-Fi access, including within educational institutions.

While it is unsurprising that developed locations have higher mobile and Internet penetration rates, a common theme in developing countries is that penetration is growing rapidly. Unlike developed countries, where mobile Internet access is an alternative and complement to fixed Internet access, in many developing countries mobile phones – which increasingly means smartphones – are the primary or sole means of Internet access for large sections of the population. This becomes clear in a context like Laos, for instance, where students are now increasingly accessing the Internet through smartphones rather than needing to visit Internet cafés.

Countries like China, India, Japan, and South Korea have a number of local hardware and software companies, and some have a produced a considerable amount of well-known software, with examples including South Korea's KakaoTalk (카카오톡) and China's WeChat (微信). This local focus may have the effect of reinforcing users' everyday "cultural landscapes," as noted in the South Korea report, while having the educational advantage of allowing teachers to bypass unpopular institutional LMSs in the process of "taking education to where students already are," as noted in the China report.

In terms of hardware, most country reports focus on laptop computers, tablets, and smartphones, which form an ecosystem of digital technologies that can be exploited for education, especially with the expansion of Bring Your Own Device policies across the region. Interestingly, however, the early entry of a country into hardware (and software) markets may not always translate into a long-term advantage, as seen in the case of Japan with its now famous Galápagos Effect (ガラパゴス化) where, for example, mobile phones evolved in a direction different in some ways from the rest of the world, placing certain limitations on future developments. Nor does a large-scale, government-sponsored hardware program, such as One Tablet Per Child in Thailand, have any guarantee of longevity, with this project now having been suspended. None of the reports make explicit reference to newly emerging and educationally promising hardware like smartwatches or smart glasses (e.g., Bower and Sturman 2015; Pegrum 2016a), but in line with current educational interest in independently or semi-independently mobile learning technologies such as robots (e.g., Hung et al. 2013), it is noteworthy that robotics rates a mention in the Philippines report.

In terms of software, in everyday life in both developed and developing contexts, there is a strong focus on the use of web 2.0/social media services (like Facebook, Instagram, Twitter and YouTube) and/or messaging services (like KakaoTalk, WeChat and WhatsApp), including the social networking facilitated by these platforms, flagged up in South Korea as reinforcing "traditional modes of sociality and

cultural identity" (Ok 2011, p. 329). Games and gaming, often with educational purposes, surface in many of the country reports, including a reference to a Massively Multiplayer Online Role-Playing Game (MMORPG) format in Hong Kong.

The current international educational interest in virtual reality (e.g., Lewis 2016) is reflected in the Japan report, and as a future trend in the Thailand report. Meanwhile, the international educational interest in augmented reality (e.g., Bacca et al. 2014; Dunleavy and Dede 2014; Radu 2014) is evidenced in the Japan, Philippines, and Singapore reports, is present by implication in the Hong Kong report, and is again mentioned as a future trend in the Thailand report. Curiously, despite growing global interest in artificial intelligence (AI) – including in countries such as China and Japan (Hsu 2017; Jolley 2015) – the Thailand report is the only one to mention its role, alongside other future projections.

Teaching and Learning Activities with Mobile Technologies

As mentioned in a number of developed and developing country reports, and implied in many others, the widespread use of digital and mobile technologies in society at large does not necessarily equate to the widespread use of these devices in education. This naturally leads to the question of what additional factors are necessary or helpful in supporting educational deployment of these technologies.

It is interesting to note that in most countries the government is taking a role in promoting digital and sometimes specifically mobile learning. This is often done via the governments' educational arms, such as Hong Kong's Education Bureau, which provides mobile apps to teachers; Singapore's Ministry of Education, which is now in the midst of executing its fourth five-year ICT Masterplan; and Taiwan's Ministry of Education, which provides a platform for teachers to share mobile learning experiences. In the developing world, the Philippine Department of Education's five-year ICT4E Strategic Plan encouraged new modes of educational delivery, including mobile learning, with the Philippine Digital Strategy of 2011–2016 promoting this further. Similarly, the Vietnamese Government's 2011–2020 Education Development Strategy includes a focus on ICTs, while the Malaysia Education Blueprint 2013–2025 includes the leveraging of ICTs as one of 11 transformational shifts in education, linked to the 1BestariNet project to provide high-speed Internet access to schools, and the rollout of the Frog LMS. The Thai Government, for its part, has set up a Government Application Center which offers freely downloadable apps, including educational apps, while the Office of the Basic Education Commission (OBEC), part of the Ministry of Education, hosts an OBEC Content Center, which offers K12 educational apps and authoring tools. Meanwhile, the Chinese, Indian, Indonesian, and South Korean governments, though their relevant ministries, have been working on digitizing textbooks, with the first three of these projects referred to as the e-Schoolbag, ePathshala, and e-Sabak initiatives, respectively.

The interwoven roles of the public and private sectors surface in many reports, potentially involving, in varying combinations, different levels of governments and their educational divisions; universities, and research institutes; telecommunications

and technology companies; and nongovernmental organizations (NGOs), as seen in contexts as diverse as Cambodia, China, India, Indonesia, Myanmar, the Philippines, Singapore, South Korea, and Taiwan. In Myanmar, for instance, the Connect to Learn project promoting mobile learning is supported by the Ministry of Education, Ericsson, UNESCO and other partners; in the Philippines, the Global Bridge IT program, which spreads digital resources through mobile technologies, has been supported by the Department of Education, Ayala Foundation, Nokia, Globe Telecom, Pearson Foundation, Toshiba, and Microsoft; and in Thailand, the Mobile Literacy for Out-of-School Children project is supported by the Ministry of Education, Microsoft and True Corporation. In countries where there is less direct government support, as in Japan, private companies may take on a correspondingly larger role. And while one-to-one initiatives are sometimes promoted at country level, as in the government-driven e-textbook projects mentioned above, in other locations it is up to individual educational institutions – which may initially mean private schools – to implement one-to-one computing or tablet initiatives, as noted in Macau, Malaysia, and the Philippines.

In developing countries in particular, social justice initiatives seek to overcome regional disparities and urban-rural divides (cf. Pegrum 2014). In some countries, school enrolment falls far below the targeted 100%, even at primary level; thus, in a location like Myanmar, a first priority is increasing primary school enrolment, in line with the United Nations Millennium Development Goals (and the post-2015 Sustainable Development Goals). Digital technologies are widely seen as having a role to play in expanding access to quality education. The Laos Ministry of Education and Sports, for instance, has set up a project to pilot the establishment of ICT centers in provincial schools, though this project faces challenges in terms of limited digital content and limited Internet bandwidth. In part due to a lack of fixed infrastructure outside the cities in large developing countries like China and Indonesia, there has been a focus on the use of mobile devices. The broad reach of mobile approaches can also be seen in the aforementioned Connect to Learn project in Myanmar and the Mobile Literacy for Out-of-School Children project in Thailand, while in Cambodia the Smart Books software helps to compensate for a lack of hard-copy textbooks, and in the Philippines there are co-operative partnerships providing informal mobile learning for those with limited access to the educational system. There is also scope for on-demand learning through apps which may supplement students' formal learning. It is reported that in India and Vietnam exam preparation platforms are popular, while in China there is great demand for English language learning apps. In India, digital technologies are viewed as a way of managing "diversity challenges" in a nation where students may be subject to varying state policies and learning in different languages.

Internationally, as reported in Churchill and Pegrum (2017), some key areas of educational exploration have included multimodal materials delivery, interactions, representations, and creations (e.g., Churchill 2017; Eisenlauer 2014; Kukulska-Hulme and Pegrum in press). In Asia, large-scale textbook digitization initiatives in countries like China and South Korea are likely to promote both multimodality and personalization of learning. Yet it would seem from the country reports that much

multimodal online learning content, whether delivered via e-textbooks or apps or a combination of both, primarily involves information delivery accompanied by quizzes. Multimodal games and gamified apps can be highly engaging, and these are used with students, for example, in China, Hong Kong, Malaysia, and the Philippines. Going further, the concept of students becoming involved in multimodal creation and production with digital technologies is mentioned in reports from Malaysia, the Philippines, and Singapore, with a focus on app development in the first of these, and augmented reality app deployment in the last.

Internationally, there is a strong focus on digital collaboration and networking (e.g., Alhinty 2015; Ilic 2015; Pachler et al. 2012), something which is facilitated by the kinds of web 2.0 or social media platforms which are widely mentioned in the Asian country reports. In Malaysia, for example, school students are introduced to web 2.0 tools ranging from Kahoot! to Padlet, and it is indicated that similar kinds of tools are being used in at least some schools in the Philippines.

Internationally, there is also a focus on seamless learning inside and outside the classroom (e.g., Wong et al. 2012; Wong and Looi 2011). It is notable that two Asian country reports make explicit mention of seamless learning, namely Hong Kong and Singapore, with this idea being implicit in many other reports which highlight the use of mobile apps as a complement or even alternative to formal educational structures.

Finally, there is also a major international focus on the development of new literacies essential for twenty-first-century life (e.g., Frawley and Dyson 2014; Pegrum 2016b). There is an acknowledgment of the importance of so-called twenty-first-century skills, which include communication, collaboration, critical thinking, and creativity, in the Hong Kong and Taiwan reports. The development of digital literacies is essential to support such skills (e.g., Dudeney et al. 2013), and it is interesting to see that in some contexts, like Malaysia, the Philippines, and Singapore, students are being introduced to coding and creating with digital technologies, while students in Brunei (at least at tertiary level) are developing learning apps.

It is evident from the reports from developed and developing countries alike that digital and mobile technologies are seen as having potential value across a whole range of subject areas, from literacy and numeracy through to Science, Technology, Engineering and Maths (STEM); indeed, the STEM area, which has recently become a major focus in education systems worldwide, is mentioned explicitly in the reports from Cambodia, the Philippines, and Vietnam. Nevertheless, despite all of the apparent potential, in some developed contexts, integration of digital technologies in schools is still limited, as in Macau, and in some developing contexts there is little use of digital technologies at all, as in Laos. In some locations, like Macau, many schools may ban phones, while in others, like Malaysia, the Ministry of Education has banned phones. In various reports, challenges with digital technologies have been identified as arising around practical issues like a lack of electricity (Indonesia), limited and/or unstable Internet connectivity (Indonesia, Laos, Malaysia, Philippines), cost (China, Laos, Macau, Philippines), time (Macau), limited IT support (Macau), and sustainability (Singapore). There are concerns over students being distracted or disturbed in class (China, Indonesia, Malaysia); this arises against a

background of broader societal concern over technology addiction (South Korea) and mental health issues for students (Indonesia). There are fears over physical health problems like poor eyesight (China), and potentially ethical issues too (Indonesia). There are also policy restrictions designed to protect student privacy (Japan). In addition, parents, families, and other stakeholders may need to be convinced of the value of digital, and especially mobile, learning, as noted in China, Indonesia, and Macau.

Pedagogical Approaches to Mobile Technologies

It has been argued that today's mobile hardware and software present opportunities for pedagogical transformation (e.g., Cochrane 2013; Kearney et al. 2015; Lindsay 2016). Certainly, some of the Asian reports explicitly mention the notion of transforming pedagogy, shifting it away from didactic modes and towards collaborative, constructivist modes, as discussed, for example, in Macau.

It has become evident in international studies that there are at least three levels, or paradigms, of mobile learning (e.g., Churchill et al. 2014; Pegrum 2014, 2016c). At the first level, the devices are mobile, but the learners and the learning experience are not. Here, mobile devices are essentially treated as a replacement for, rather than a complement to, computers (Burston 2016). Typically, the pedagogy largely involves information transmission or behaviorist drills, with some scope for personalization but usually less scope for collaboration or authenticity (cf. Burden and Kearney 2017). E-textbook initiatives would generally fall into this category, as do many social justice or access initiatives in developing countries.

At the second level, the devices and the learners are mobile, but the learning experience is still not; here there is usually scope for both personalization and collaboration. Learners might be mobile in the classroom, collaborating around the technologies, or they might be mobile in their everyday lives, engaging in (probably distance) learning in moments of downtime in varying locations. However, in neither case does the context influence the learning. A key related concept is anytime, anywhere learning, often app-based in nature, as referenced in the Hong Kong and South Korea reports, and implied in many other country reports.

At the third level, the devices, the learners, and the learning experience are all mobile, opening up possibilities for education which is personalized, collaborative, and authentic. This is currently a major focus internationally in studies that in varying degrees emphasize contextual learning (e.g., Churchill and Lam 2017; Reinders and Pegrum 2016; Sharples 2016) and seamless learning across contexts (e.g., Song 2014; Wong and Looi 2011). While seamless learning may involve learning that bears no relation to its surroundings, the most promising kinds of seamless learning have a contextual element where students can at least sometimes apply their learning in varying environments and/or can create and share multimedia records of their learning captured in those varying environments. The use of mobile devices' location awareness functionality to design contextual learning activities is evident in Hong Kong, for example, and augmented reality learning trails are

discussed in the Singapore report. In the process of engaging in and recording contextual learning activities, students are also very likely to develop a range of digital literacies.

Worldwide, there has been a great deal of commentary on the need for educators, faced with expanding possibilities for pedagogical transformation, to act as designers of learning materials, learning environments, and learning experiences for their students; they might do so independently or in collaboration with programmers and instructional designers (Churchill and Pegrum 2017). This point has been made in the general literature about digital learning (e.g., Garcia 2014; Gee 2015; Laurillard 2012) as well as the literature that focuses more specifically on mobile learning (e.g., Hockly 2016; Milrad et al. 2013; Sharples 2016). It is widely appreciated, as noted in the China and Taiwan reports, that technology by itself does not lead to pedagogical changes. Instead, the importance of appropriate learning designs is recognized, as highlighted in the reports from Hong Kong and Taiwan. It is striking that in China's e-Schoolbag initiative, there is increasing scope for "grassroots, teacher-designed learning materials." In the Philippines, some teachers are creating their own iTunes U courses. In Hong Kong, teachers are encouraged to design customized mobile learning activities with the Beyond Campus app. In Singapore, teachers and students are creating their own augmented reality learning trails.

Some reports, from locations that stretch from Macau to the Philippines, mention the importance of appropriate teacher education or training. Hong Kong's Education Bureau supports a community of practice where teachers can share digital teaching experiences, while Taiwan's Ministry of Education provides teachers with a platform to share innovative mobile learning practices. In Myanmar, the Ministry of Education has partnered with UNESCO to support the integration of ICTs into preservice teacher education by qualified teacher educators.

Research on Mobile Technologies for Learning

In this rapidly evolving area, there is clearly a need for research to develop theoretical frameworks of mobile learning, linked to rigorous empirical studies (Churchill and Pegrum 2017). Internationally, there is a growing number of books and special journal issues devoted to mobile learning, each taking its own perspective on the issues at hand (e.g., Berge and Muilenburg 2013; Churchill et al. 2016; Churchill and Pegrum 2017; Lim and Churchill 2016; Palalas and Ally 2016; Parsons 2013; Traxler and Kukulska-Hulme 2016). This research is essential to better inform learning designs.

Some reports, both from developed countries like Brunei and Singapore, and developing countries like Indonesia and the Philippines, indicate that research has been conducted on learning with digital, including mobile, technologies. In Singapore's case in particular, such research often comes under the umbrella of research and development, or R&D. However, many reports indicate that academic research on the learning impact of digital technologies has been inadequate to date

and that more research is needed; this point surfaces both in developed country reports, like Brunei and South Korea, and developing country reports, like India and Thailand. It would seem that there is considerable scope for more research which relates global themes to the particular teaching and learning contexts in each location, so as to inform and improve learning designs.

Conclusion

As noted at the outset of this chapter, the country reports do not necessarily represent a complete picture of mobile learning developments in each context, but they do give us a glimpse of each context from the perspective of well-informed educators. And indeed, despite differences between these locations, it is striking to note the similarities in the themes that emerge.

It is apparent that with the continuing regional rollout of smart mobile hardware and fast mobile Internet access, there will be increased opportunities to leverage mobile learning in the future. While governmental support appears to be crucial to large-scale technological implementation, many other organizations – universities and research institutes, commercial entities, and NGOs – also have collaborative roles to play. In developing countries, such partnerships often target social justice agendas, where the pedagogy may be somewhat traditional but the emphasis is on access. In more developed locations, public-private collaborations are likely to involve integrating cutting-edge technologies into education in pedagogically sophisticated ways, with some of today's greatest promise appearing to lie in augmented reality interfaces used to support collaborative, creative learning situated in real-world settings.

Introducing new technologies, in and of itself, is no guarantee of pedagogical transformation, and it is essential that new tools are embedded in appropriate learning designs and that the challenges raised by mobile and other devices are faced squarely. This makes it all the more essential that further research is conducted to establish solid theoretical frameworks whose validity is demonstrated in empirical studies, in order to develop best practice principles that can guide governments, institutions, educators, and students on how best to capitalize on the teaching and learning potential of the mobile devices which are rapidly spreading throughout the region.

References

Abadzi, H. (2010). *Towards reading for all: Early grade reading assessment in Cambodia*. Phnom Penh: World Bank presentation. Retrieved from http://119.82.251.165:8080/xmlui/bitstream/handle/123456789/485/Towards%20Reading%20for%20All.pdf?sequence=1.

Abidin, Z., Mathrani, A., Parsons, D., & Suriadi, S. (2015). *Opportunities and challenges of mobile learning for promoting mathematical literacy*. Paper presented at the Australasian Conference on Information Systems, Adelaide. Retrieved from https://eprints.qut.edu.au/103996/1/103996.pdf.

AITI. (2016, September). *Brunei Darussalam household ICT survey report 2016.* Brunei: AITI. Retrieved from http://www.aiti.gov.bn/downloadables/Downloadables%20Library/Household%20ICT%20Survey%202016%20Report.pdf.

Aki, A. (2015, October 2). Mobile learning plugs China's education gap. *Voice of America*. Retrieved from http://blogs.voanews.com/techtonics/2015/10/02/mobile-learning-plugs-chinas-education-gap/.

Alhinty, M. (2015). Young language learners' collaborative learning and social interaction as a motivational aspect of the iPad. *International Journal of Emerging Technologies in Learning, 10*(2), 24–29. Retrieved from http://online-journals.org/index.php/i-jet/article/view/4313.

Ambient Research. (2015). *Ambient Insight: The 2014–2019 China mobile learning market*. Retrieved from http://www.ambientinsight.com/Resources/Documents/AmbientInsight-2014-2019-China-Mobile-Learning-Market-Abstract.pdf.

Arohana Scholarships. (2013). Education in Myanmar. *Arohana.* Retrieved from http://arohanascholarships.org/education-in-myanmar/.

Arthur, C. (2012, December 4). iOS v Android: App revenues, downloads and country breakdowns. *The Guardian.* Retrieved from https://www.theguardian.com/technology/appsblog/2012/dec/04/ios-android-revenues-downloads-country.

Astra, I. M., Nasbey, H., & Nugraha, A. (2015). Development of an android application in the form of a simulation lab as learning media for senior high school students. *Eurasia Journal of Mathematics, Science & Technology Education, 11*(5), 1081–1088.

Auliani, P. A. (2015, November 19). Mau Tahu hasil riset Google soal penggunaan "smartphone" di Indonesia? *Kompas.com.* Retrieved from http://tekno.kompas.com/read/2015/11/19/23084827/Mau.Tahu.Hasil.Riset.Google.soal.Penggunaan.Smartphone.di.Indonesia.

Australian Embassy (The Philippines). (2013, March 27). mr130327 – Australia supports UP research of tablet technology to raise the quality of public education. *Australian Embassy (The Philippines).* Retrieved from http://philippines.embassy.gov.au/mnla/medrel130327.html

Bacca, J., Baldiris, S., Fabregat, R., Graf, S., & Kinshuk. (2014). Augmented reality trends in education: A systematic review of research and applications. *Educational Technology & Society, 17*(4), 133–149.

Bae, J. H., & Lee, H. (2016). Design and implementation of the mobile learning app for creative problem solving activities. In J. H. Park, Y. Pan, G. Yi, & V. Loia (Eds.), *Advances in computer science and ubiquitous computing: CSA-CUTE2016* (pp. 786–792). Singapore: Springer.

Berge, Z. L., & Muilenburg, L. Y. (Eds.). (2013). *Handbook of mobile learning*. New York: Routledge.

Bernabe, K. (2013, October 14). Balancing high-tech and old-fashioned mentoring. *Philippine Daily Inquirer*. Retrieved from http://newsinfo.inquirer.net/506769/balancing-high-tech-and-old-fashioned-mentoring.

Bower, M., & Sturman, D. (2015). What are the educational affordances of wearable technologies? *Computers & Education, 88*, 343–353.

Burden, K., & Kearney, M. (2017). Investigating and critiquing teacher educators' mobile learning practices. *Interactive Technology and Smart Education, 14*(2), 110–125.

Burston, J. (2016). The reality of MALL: Still on the fringes. In A. Palalas & M. Ally (Eds.), *The international handbook of mobile-assisted language learning* (pp. 2–43). Beijing: China Central Radio & TV University Press.

Camus, M. R. (2015, December 13). Smartphone use in the Philippines seen rising to 70% by '18. *Philippine Daily Inquirer.* Retrieved from http://business.inquirer.net/204077/smartphone-use-in-ph-seen-rising-to-70-by-18.

Census & Statistics Dept, HKSAR. (2016). Thematic household survey report no. 59. Retrieved from http://www.statistics.gov.hk/pub/B11302592016XXXXB0100.pdf.

Cheng, D. (2003). *Ae framework for mobile learning development.* Paper presented at the first humanoid, nanotechnology, information technology, communication and control environment and management (HNICEM) international conference, Manila, 29–31 Mar. Retrieved from http://mysite.dlsu.edu.ph/faculty/chengd/papers/hnicem.pdf.

Chien, Y. T., & Chang, C. Y. (2015). Supporting socio-scientific argumentation in the classroom through automatic group formation based on students' real-time responses. In M. S. Khine (Ed.), *Science education in East Asia: Pedagogical innovations and research-informed practices* (pp. 549–563). Cham: Springer.

Chien, Y. T., Lee, Y. H., Li, T. Y., & Chang, C. Y. (2015). Examining the effects of displaying clicker voting results on high school students' voting behaviors, discussion processes, and learning outcomes. *Eurasia Journal of Mathematics, Science & Technology Education, 11*(5), 1089–1104.

Chonghui, L. (2016, February 14). Learning beyond the classroom. *The Star Online.* http://www.thestar.com.my/news/education/2016/02/14/learning-beyond-the-classroom/.

Churchill, D. (2017). *Digital resources for learning*. Singapore: Springer.

Churchill, N., & Lam, E. (2017). Development of students' online research skills through digital storytelling with mobile devices. In N. Churchill & D. Churchill (Eds.), Proceedings of the international mobile learning festival 2017: Mobile and emerging learning resources, activities, support and evaluation (pp. 281–286). Hong Kong: CIHCD. Retrieved from http://imlf.mobi/publications/IMLF2017Proceedings.pdf.

Churchill, D., & Pegrum, M. (2017). Editorial. Mobile learning, emerging learning design and learning 2.0. Special issue of *Interactive Technology and Smart Education, 14*(2), 90–96.

Churchill, D., Lu, J., & Chiu, T. K. F. (2014). Editorial: Integrating mobile technologies, social media and learning design. *Educational Media International, 51*(3), 163–165.

Churchill, D., Lu, J., Chiu, T. K. F., & Fox, B. (Eds.). (2016). *Mobile learning design: Theories and application*. Singapore: Springer.

CNN Philippines. (2017, March 6). Cabinet secretary: Duterte approves national broadband program. *CNN Philippines.* Retrieved from http://cnnphilippines.com/news/2017/03/06/duterte-approves-national-broadband-program.html.

Cochrane, T. (2013). M-learning as a catalyst for pedagogical change. In Z. L. Berge & L. Y. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 247–258). New York: Routledge.

Congress of the Philippines. (2014). Republic act no. 10650. *Republic of the Philippines National Government Portal.* Retrieved from https://goo.gl/hrCfmN.

Cristano, Y. (2014). *Text2Teach: What we've learned from a decade of mobile learning in primary schools in the Philippines.* Summary of paper presented at the UNESCO mobile learning symposium, Paris. Retrieved from http://www.unesco.org/new/en/unesco/themes/icts/m4ed/unesco-mobile-learning-week-2014/symposium/breakout-sessions/text2teach/.

Cronin, M. J. (2017). Impact investing at the base of the pyramid: Unitus seed fund. In M. J. Cronin & T. C. Dearing (Eds.), *Managing for social impact* (pp. 217–235). New York: Springer.

Darmanto, H. Y., & Hermawan, B. (2016). Mobile learning application to support Mandarin language learning for high school student. *Imperial Journal of Interdisciplinary Research, 2* (4), 402–407. Retrieved from http://www.onlinejournal.in/IJIRV2I4/076.pdf.

Demegillo, J. (2017, January 17). FIT 2017 by Xavier School. *EduTech*. Retrieved from http://asia.blog.terrapinn.com/edutech/2017/01/17/fit-2017-by-xavier-school/.

DepEd (Philippines). (2008). *Five-year information and communication technology for education strategic plan (DepED ICT4E Strategic Plan)*. Retrieved from http://www.cfo-pso.org.ph/pdf/8thconferencepresentation/day1/ECPangilinan04.pdf.

DICT (Philippines). (n.d.-a). *Philippine digital strategy.* Retrieved from http://www.dict.gov.ph/wp-content/uploads/2014/06/philippine-digital-strategy-2011-2015.pdf.

DICT (Philippines). (n.d.-b). *The state of Ph Telecoms service*. Retrieved from http://www.dict.gov.ph/the-state-of-ph-telecoms-service/.

DSEJ (Macao). (2015). *Statistical profile of non-tertiary education in Macao*. Retrieved from http://www.dsej.gov.mo/~webdsej/www/statisti/2015/index-e.html.

Dudeney, G., Hockly, N., & Pegrum, M. (2013). *Digital literacies*. Harlow: Pearson.

Dunleavy, M., & Dede, C. (2014). Augmented reality teaching and learning. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (4th ed., pp. 735–745). New York: Springer.

EDB (HKSAR). (2014). *The fourth strategy on information technology in education: Raising IT potential. Unleashing learning power. A holistic approach. Consultation document.* Hong Kong: Education Bureau. Retrieved from http://www.edb.gov.hk/attachment/en/edu-system/primary-secondary/applicable-to-primary-secondary/it-in-edu/it-in-edu/Policies/4th_consultation_eng.pdf.

Eisenlauer, V. (2014). Multimodality in mobile-assisted language learning. In M. Kalz, Y. Bayyurt & M. Specht (Eds.), Mobile as mainstream - towards future challenges in mobile learning. 13th world conference on mobile and contextual learning, mLearn 2014, Istanbul, Turkey, November 3–5, 2014, proceedings (pp. 328–338). Cham: Springer.

Frawley, J. K., & Dyson, L. E. (2014). Mobile literacies: Navigating multimodality, informal learning contexts and personal ICT ecologies. In M. Kalz, Y. Bayyurt & M. Specht (Eds.), Mobile as mainstream - towards future challenges in mobile learning. 13th world conference on mobile and contextual learning, mLearn 2014, Istanbul, Turkey, November 3–5, 2014, proceedings (pp. 377–390). Cham: Springer.

Frieden, R. (2005). Lessons from broadband development in Canada, Japan, Korea and the United States. *Telecommunications Policy, 29*(8), 595–613.

Garcia, A. (2014). Teacher agency and connected learning. In A. Garcia (Ed.), *Teaching in the connected learning classroom* (pp. 6–9). Irvine: Digital Media and Learning Research Hub. Retrieved from http://dmlhub.net/publications/teaching-connected-learning-classroom.

Garcia, A. S., Morrison, K., Tsoi, A. C., & He, J. (2014). *Managing complex change in school: Engaging pedagogy, technology, learning and leadership*. New York: Routledge.

Gee, J. P. (2015). *Literacy and education*. New York: Routledge.

GO-Globe. (2014, August 11). Smartphone usage in Hong Kong: Statistics and trends. *GO-Globe.* Retrieved from http://www.go-globe.hk/blog/smartphone-usage-hong-kong/.

GovHK. (2017, May). Government mobile apps on culture, leisure and sports. *GovHK.* Retrieved from http://www.gov.hk/en/residents/culture/mobile/mobile_app.htm.

GSMA Intelligence. (2015). Data » Markets » Asia » Korea, South. Retrieved from https://www.gsmaintelligence.com/markets/1948/dashboard/.

Gu, X., Xu, X., Wang, H., & Crook, C. (2016). Design possibilities for the e-schoolbag: Addressing the 1:1 challenge within China. *British Journal of Educational Technology, 48*(2), 571–585.

Harpur, P. (2017, March). South Korea – Telecoms, mobile, broadband and digital media – Statistics and analyses. *BuddeComm.* Retrieved from https://www.budde.com.au/Research/South-Korea-Telecoms-Mobile-Broadband-and-Digital-Media-Statistics-and-Analyses.

Hawkinson, E. (2017). Japan's Galapagos syndrome impact on educational technology development and design. *The Journal of Scientific Social Studies, 1*(2), 58–63.

Hawkinson, E., Mehran, P., & Alizadeh, M. (2017). Using MAVR to bring new dimensions to the classroom. *The Language Teacher, 41*(3), 30–32.

He, X., & Wray, D. (2017). Digital literacies in a Chinese secondary school. In A. Marcus-Quinn & T. Hourigan (Eds.), *Handbook on digital learning for K-12 schools* (pp. 233–249). Cham: Springer International Publishing.

Hjorth, L. (2007). Home and away: A case study of the use of Cyworld mini-hompy by Korean students studying in Australia. *Asian Studies Review, 31*(4), 397–407.

Hockly, N. (2016). Designer learning: The teacher as designer of mobile-based classroom learning experiences. In E. Martín-Monje, I. Elorza, & B. García Riaza (Eds.), *Technology-enhanced language learning for specialized domains: Practical applications and mobility* (pp. 140–150). London: Routledge.

Hsu, S. (2017, July 3). China is investing heavily in artificial intelligence, and could soon catch up to the U.S. *Forbes.* https://www.forbes.com/sites/sarahsu/2017/07/03/china-is-investing-heavily-in-artificial-intelligence-and-could-soon-catch-up-to-the-u-s/.

Hung, I.-C., Chao, K.-J., Lee, L., & Chen, N.-S. (2013). Designing a robot teaching assistant for enhancing and sustaining learning motivation. *Interactive Learning Environments, 21*(2), 156–171.

Husada, T. R. (2015, March 9). Mengapa mobile learning di Asia Tenggara berpotensi mengungguli negara-negara lain di dunia. *Tech in Asia*. Retrieved from https://id.techinasia.com/potensi-mobile-learning-asia-tenggara.

IDC. (2016, June 16). The Philippines is now the fastest growing smartphone market in ASEAN, according to IDC. *IDC.* Retrieved from https://www.idc.com/getdoc.jsp?containerId=prAP41533516.

Ilic, P. (2015). The effects of mobile collaborative activities in a second language course. *International Journal of Mobile and Blended Learning, 7*(4), 16–37.

IMDA (Singapore). (2014). Annual survey on infocomm usage in households and by individuals for 2014. *Infocomm Media Development Authority.* Retrieved from https://www.imda.gov.sg/~/media/imda/files/industry%20development/fact%20and%20figures/infocomm%20survey%20reports/0301%202014%20hh%20public%20report%20final.pdf?la=en.

Internet World Stats. (2016a). Laos internet usage, broadband and telecommunications reports. *Internet World Stats.* Retrieved from http://www.internetworldstats.com/asia/la.htm.

Internet World Stats. (2016b). Philippines internet usage stats and marketing report. *Internet World Stats.* Retrieved from http://www.internetworldstats.com/asia/ph.htm.

Internet World Stats. (2017). Internet usage in Asia. *Internet World Stats.* Retrieved from http://www.internetworldstats.com/stats3.htm.

Ishii, K. (2003). Internet use via mobile phone in Japan. *Telecommunications Policy, 28*(1), 43–58.

Jin, D. Y., & Yoon, K. (2016). Reimagining smartphones in a local mediascape: A cultural analysis of young KakaoTalk users in Korea. *Convergence, 22*(5), 510–523.

Jolley, R. (2015, November). Artificial intelligence – Can Japan lead the way?. *The Journal*. https://journal.accj.or.jp/artificial-intelligence-can-japan-lead-the-way/.

Jong, M. S. Y. (2014). Elementary students' view of collaborative knowledge building in Learning-Villages. *Interaction Design and Architecture(s), 21*, 37–56.

Jong, M. S. Y., & Tsai, C. C. (2016). Understanding the concerns of teachers about leveraging mobile technology to facilitate outdoor social inquiry learning: The EduVenture experience. *Interactive Learning Environments, 24*(2), 328–344.

Kearney, M., Burden, K., & Rai, T. (2015). Investigating teachers' adoption of signature mobile pedagogies. *Computers & Education, 80*, 48–57.

Kemp, S. (2017, February 16). Digital in Southeast Asia in 2017. *We are Social.* Retrieved from https://wearesocial.com/special-reports/digital-southeast-asia-2017.

Kinshuk, & Huang, R. (Eds.). (2015). *Ubiquitous learning environments and technologies*. Berlin: Springer.

Koh, T. S., & Lee, S. C. (2008a). Digital skills and education: Singapore's ICT master planning for the school sector. In S. K. Lee, C. B. Goh, B. Fredriksen, & J. P. Tan (Eds.), *Toward a better future: Education and training for economic development in Singapore since 1965*. Washington, DC: The World Bank.

Koh, T. S., & Lee, S. C. (2008b). *Information communication technology in education: Singapore's ICT masterplans, 1997–2008*. Singapore: World Scientific.

Kukulska-Hulme, A., & Pegrum, M. (in press). Linguistic diversity in online and mobile learning. In A. Creese & A. Blackledge (Eds.), *Handbook on language and superdiversity.* New York: Routledge.

Kyaw, T. H. (2013). Primary education in Myanmar. *Accent learning.* Retrieved from http://www.accent.ac.nz/elto/articles/primary-education-myanmar.

Lam, L. (2012, December 23). Macau's St. Paul's School biggest in region to fully embrace e-learning. *South China Morning Post*. Retrieved from http://www.scmp.com/news/hong-kong/article/1111022/macaus-st-pauls-school-biggest-region-fully-embrace-e-learning.

Laurillard, D. (2012). *Teaching as a design science: Building pedagogical patterns for learning and technology.* New York: Routledge.

Lee-Chua, Q. N. (2013a, August 5). Xavier leads the way in integrating technology. *Philippine Daily Inquirer*. Retrieved from http://newsinfo.inquirer.net/459219/xavier-leads-the-way-in-integrating-technology.

Lee-Chua, Q. N. (2013b, August 12). Innovative tech in Xavier. *Philippine Daily Inquirer.* Retrieved from http://newsinfo.inquirer.net/464219/innovative-tech-in-xavier.

Lewis, D. (2016, June 2). The top 10 companies working on education in virtual reality and augmented reality. *Touchstone Research.* Retrieved from http://touchstoneresearch.com/the-top-10-companies-working-on-education-in-virtual-reality-and-augmented-reality/.

Li, S. (2013, May 9). Is it time to popularize e-Schoolbags? *Beijing Review.* Retrieved from http://www.bjreview.com.cn/Cover_Stories_Series_2013/2013-05/06/content_571206.htm.

Librero, F., Ramos, A., Ranga, A., Triñona, J., & Lambert, D. (2007). Uses of the cell phone for education in the Philippines and Mongolia. *Distance Education, 28*(2), 231–244.

Lim, C. P., & Churchill, D. (2016). Editorial: Mobile learning. *Interactive Learning Environments, 24*(2), 273–276.

Lindsay, L. (2016). Transformation of teacher practice using mobile technology with one-to-one classes: M-learning pedagogical approaches. *British Journal of Educational Technology, 47*(5), 883–892.

List of countries by Human Development Index. (2017, July 19). *Wikipedia.* Retrieved from https://en.wikipedia.org/wiki/List_of_countries_by_Human_Development_Index.

Mahardy, D. (2015, January 8). Apa beda sistem e-Sabak dan buku sekolah elektronik? *Liputan.* Retrieved from http://tekno.liputan6.com/read/2158024/apa-beda-sistem-e-sabak-dan-buku-sekolah-elektronik.

Medenilla, K. (2016, June 18). Philippines: 'Fastest-growing' smartphone nation in Southeast Asia. *Asian Journal*. Retrieved from http://asianjournal.com/news/philippines-fastest-growing-smartphone-nation-in-southeast-asia/.

MEXT (Japan). (2015). Chapter 1: Current status of education in Japan and the challenges we face. *MEXT.* Retrieved from http://www.mext.go.jp/en/policy/education/lawandplan/title01/detail01/sdetail01/1373814.htm.

MHRD (India). (2016). *Educational statistics at a glance.* New Delhi: MHRD. Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/statistics/ESG2016_0.pdf.

Milrad, M., Wong, L.-H., Sharples, M., Hwang, G.-J., Looi, C.-K., & Ogata, H. (2013). Seamless learning: An international perspective on next-generation technology-enhanced learning. In Z. L. Berge & L. Y. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 95–108). New York: Routledge.

MITHI (Philippines). (n.d.). *MITHI: Medium-term information and communications technology harmonization initiative.* Retrieved from http://mithi.gov.ph/mithi/.

MOC (Thailand). (2016, December). *Thailand 4.0: Megatrends to watch.* Retrieved from http://www.km.moc.go.th/download/doc/Othe_60/1/Thailand%204.0%20Megatrend%20to%20watch.pdf.

MoCI (Indonesia). (2016). Survei akses dan penggunaan TIK di sektor pendidikan-Kominfo tahun 2013. Retrieved from https://statistik.kominfo.go.id/site/data?idtree=436&iddoc=1294&data-data_page=3.

MOE. (2015). Students' internet usage survey report in 2015 [translated from Chinese]. *Ministry of Education*. Retrieved from http://www.edu.tw/News_Content.aspx?n=0217161130F0B192&s=F1AA06D56E8D6B20.

MOE (Malaysia). (2013). *Malaysia education blueprint 2013–2025 (Preschool to post-secondary education)*. Putrajaya: MOE. Retrieved from http://www.moe.gov.my/images/dasar-kpm/articlefile_file_003108.pdf.

MOE (Singapore). (n.d.). Masterplan 4. *ICT Connection.* Retrieved from http://ictconnection.moe.edu.sg/masterplan-4.

MoEC (Indonesia). (2016). Siswa. *Kementerian Pendidikan dan Kebudayaan.* Retrieved from https://kemdikbud.go.id/.

Monzon, G. C., Ramos, J. C., Jacob, J. B., & Naynes, F. K. (2016). A mobile learning Android application for beginner reader in Filipino. *International Journal of Computer Science and Information Technology Research, 4*(2), 164–174. Retrieved from file://uniwa.uwa.edu.au/

userhome/staff7/00026467/Downloads/A%20Mobile%20Learning%20Android%20Application-3161.pdf.
MoRTHE (Indonesia). (2017). Sistem pembelajaran daring Indonesi. Retrieved from http://kuliahdaring.dikti.go.id/.
Na, E. (2001). Yidongjeonhwa chetaekui yeonghyangeul michineun yidongjeonhwa communicationui sokseonge gwanhan yeongu. *Korean Journal of Journalism & Communication Studies, 45*(4), 189–228.
Narayan, A., & Murgai, R. (2016, Apr). *Looking back on two decades of poverty and well-being in India*. Policy research working paper 7626. World Bank Group. http://documents.worldbank.org/curated/en/841931468196177423/pdf/WPS7626.pdf.
Nasongkhla, J., Thammetar, T., & Chen, S.-H. (2015). Thailand OERs and MOOCs country report. In B. Kim (Ed.), *MOOCs and educational challenges around Asia and Europe* (pp. 121–135). Seoul: KNOU Press. Retrieved from http://asemlllhub.org/fileadmin/www.asem.au.dk/publications/MOOCs_and_Educational_Challenges_around_Asia_and_Europe_FINAL.pdf.
National Teachers' Month. (2016, August 27). 21st century teacher: Winona Diola. *Facebook.* Retrieved from https://www.facebook.com/NTMPhils/posts/1220409044667366:0.
Nguyen, T. D. (2012, August 27). Decision no. 711/QD-TTg of June 13, 2012: Approving the 2011-2020 education development strategy. *Vietnam Law & Legal Forum.* Retrieved from http://vietnamlawmagazine.vn/decision-no-711-qd-ttg-of-june-13-2012-approving-the-2011-2020-education-development-strategy-4704.html.
Nguyễn, B. (2016). Digital in 2016 Vietnam – We are social. *SlideShare.* Retrieved from https://www.slideshare.net/binhnguyenplus/digital-in-2016-vietnam-we-are-social.
Noh, K. S., Ju, S. H., & Jung, J. T. (2011). An exploratory study on concept and realization conditions of smart learning. *Journal of Digital Convergence, 9*(2), 79–88.
Noviandari, L. (2015, January 22). 63 juta orang Indonesia akses Facebook melalui handphone di tahun 2015, penetrasi tertinggi di dunia. Tech in Asia. Retrieved from https://id.techinasia.com/jumlah-pengguna-facebook-mobile-indonesia-tertinggi-dunia.
Odilao, N. L., & Bautista, J. K. (2014). Utilization of mobile learning devices as assistive tools employed by parents and teachers in the early intervention of children with autism spectrum disorder in Cavite. *De La Salle University.* Retrieved from www.dlsu.edu.ph/conferences/dlsu_research_congress/2014/_pdf/GC-I-01.pdf.
OECD. (2016). Households with broadband access. *OECD data.* Retrieved from https://data.oecd.org/broadband/households-with-broadband-access.htm#indicator-chart.
Office of Director-General of Education Malaysia. (2009). Surat pekeliling ikhtisas bil 2/2009: Penguatkuasaan larangan membawa dan mengguna telefon bimbit oleh murid di sekolah. *MOE.* Retrieved from http://www.moe.gov.my/images/pekeliling/2009/circularfile_file_000297.pdf.
Ok, H. Y. (2011). New media practices in South Korea. *International Journal of Communication, 5*, 320–348.
Pachler, N., Ranieri, M., Manca, S., & Cook, J. (2012). Editorial: Social networking and mobile learning. *British Journal of Educational Technology, 43*(5), 707–710.
Padmo, D., Sri Ardiasih, L., Idrus, O., & Huda, N. (2015). *The use of mobile learning and its future direction of development in Indonesia.* Paper presented at the 26th ICDE World Conference, Sun City, South Africa, 14–16 Oct.
Pakpahan, R. (2016). Computer-based national exam model: Its benefits and barriers. *Jurnal Pendidikan dan Kebudayaan, 1*(1), 19–35.
Palalas, A., & Ally, M. (Eds.). (2016). *The international handbook of mobile-assisted language learning*. Beijing: China Central Radio & TV University Press.
Pandit, V., Lebraud, J. C., & Seetharaman, R. (2012 April). Transforming learning through mEducation. *McKinsey on Society.* Retrieved from http://mckinseyonsociety.com/transforming-learning-through-meducation/.
Parsons, D. (Ed.). (2013). *Innovations in mobile educational technologies and applications*. Hershey: Information Science Reference.

Pegrum, M. (2014). *Mobile learning: Languages, literacies and cultures*. Basingstoke: Palgrave Macmillan.

Pegrum, M. (2016a). Future directions in mobile learning. In D. Churchill, J. Lu, T. K. F. Chiu, & B. Fox (Eds.), *Mobile learning design: Theories and application* (pp. 413–431). Singapore: Springer.

Pegrum, M. (2016b). Languages and literacies for digital lives. In E. Martín-Monje, I. Elorza, & B. García Riaza (Eds.), *Technology-enhanced language learning for specialized domains: Practical applications and mobility* (pp. 9–22). London: Routledge.

Pegrum, M. (2016c). Three agendas for MALL. In A. Palalas & M. Ally (Eds.), *The international handbook of mobile-assisted language learning* (pp. 86–112). Beijing: China Central Radio & TV University Press.

Pena-Bandalaria, M. d (2007). Impact of ICTs on open and distance learning in a developing country setting: The Philippine experience. *The International Review of Research in Open and Distributed Learning*, *8*(1). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/334/792.

Phong, K., Srou, L., & Solá, J. (2016). *Mobile phones and internet use in Cambodia 2016*. Open Institute/USAID/The Asian Foundation. Retrieved from http://www.open.org.kh/research/phones_2016.pdf.

Radu, I. (2014). Augmented reality in education: A meta-review and cross-media analysis. *Personal and Ubiquitous Computing, 18*, 1533–1543.

Rai, S. (2016, January 6). India just crossed 1 billion mobile subscribers milestone and the excitement's just beginning. *Forbes*. Retrieved from https://www.forbes.com/sites/saritharai/2016/01/06/india-just-crossed-1-billion-mobile-subscribers-milestone-and-the-excitements-just-beginning/#29f41df67db0.

Ramos, A., Librero, F., Triñona, J., & Ranga, A. (2007). *Using a ubiquitous technology for m-learning in Asia: Project MIND in the Philippines*. Paper presented at the 2nd international conference on e-learning (ICEL), New York, June. *R*etrieved from http://www.pandora-asia.org/downloads/07-ICEL_Ramos.pdf.

Red, E. R., Domingo, K. E. D., Santos, K. M. F., & Banaag, J. T. (2013). Design and development of a mobile game-based learning application in synonyms, antonyms and homonyms. *International Journal of the Computer, the Internet and Management, 21*(3), 32–38. Retrieved from www.ijcim.th.org/past_editions/2013V21N3/5.Page_32-38.pdf.

Reinders, H., & Pegrum, M. (2016). Supporting language learning on the move: An evaluative framework for mobile language learning resources. In B. Tomlinson (Ed.), *SLA research and materials development for language learning* (pp. 219–231). New York: Routledge.

Santos, M. E., Luebke, A., Taketomi, T., Yamamoto, G., Sandor, C., Kato, H., & Rodrigo, M. M. (2010). Augmented reality as multimedia: A case for situated vocabulary learning. *Research and Practice in Technology Enhanced Learning, 10*(10), 1–26.

Seangly, V., Suyoto, A., & Santoso, J. (2016). The development of mobile learning "Imbuhan" grammar Indonesian language for Cambodian students. *International Journal of Computer Science Trends and Technology, 4*(6), 140–144. Retrieved from http://www.ijcstjournal.org/volume-4/issue-6/IJCST-V4I6P25.pdf.

Seyal, A. H., Rahman, M. N., Ramlee, R., & Armanadurani, A. R. (2014). A preliminary study of students attitude on m-learning: An application of technology acceptance model. *International Journal of Information and Education Technology, 5*(8), 609–614.

Seyal, A. H., Rahman, M. N., & Omar, M. S. (2015). Diffusion of m-learning in higher education: The case of Technical University in Brunei. In Conference proceedings: 16th annual global information technology management association (GITMA) world conference 2015, 21–23 June 2015, GITMA, St. Louis.

Seyal, A. H., Rahman, M. N., Siau, N. Z., & Mey, Y. S. (2017). Examining m-learning in higher education: An application of theory of planned behavior. In A. H. Seyal & M. N. Rahman (Eds.), *Theory of planned behavior: New research*. New York: Nova Science.

Sharples, M. (2016). Making sense of context for mobile learning. In J. Traxler & A. Kukulska-Hulme (Eds.), *Mobile learning: The next generation*. New York: Routledge.

Sokhean, B. (2014, March 27). Mobile users top 20 million, internet usage still rising. *The Cambodia Daily.* https://www.cambodiadaily.com/archives/mobile-users-top-20-million-internet-usage-still-rising-55024/.

Song, Y. (2014). "Bring your own device (BYOD)" for seamless science inquiry in a primary school. *Computers & Education, 74*, 50–60.

Song, Y. (2016). "We found the 'black spots' on campus on our own": Development of inquiry skills in primary science learning with BYOD (Bring your own device). *Interactive Learning Environments, 24*(2), 291–305.

Song, Y., & Kapur, M. (2017). How to flip the classroom – "Productive failure" or "traditional flipped classroom" pedagogical design? *Educational Technology & Society, 20*(1), 292–305.

Soon, S. T. (2014). Leveraging virtual learning environment to scale up quality teaching and learning in Malaysia. *Asia-Pacific Collaborative Education, 10*(1), 1–17.

Statista. (n.d.). Number of smartphone users in China from 2013 to 2022 (in millions). *Statista.* Retrieved from https://www.statista.com/statistics/467160/forecast-of-smartphone-users-in-china/.

Sulisworo, D. (2017). *Mobile learning application development fostering high order thinking skills on physics learning*. Paper presented at the international conference on education, business and management (ICEBM-2017), Bali, 8–9 Jan. Retrieved from http://eprints.uad.ac.id/6540/.

Sulisworo, D., & Toifur, M. (2016). The role of mobile learning on the learning environment shifting at high school in Indonesia. *International Journal of Mobile Learning and Organisation, 10*(3), 159–170.

Susanti, A., & Tarmuji, A. (2016). Techniques of optimizing WhatsApp as an instructional tool for teaching EFL writing in Indonesian senior high schools. *International Journal on Studies in English Language and Literature, 4*(10), 26–31.

Telco.Ph. (2016, November 8). Faster speeds, better internet access in 2017 for laggard Philipines: Government. *Telco.Ph.* Retrieved from http://www.telco.ph/internet/faster-speeds-better-internet-access-2017-laggard-philippines-government/.

Tifani, O. A., Putra, P. W., Shabrina, S. A., Herlin, E., Nuranisya, A., Rachman, A., Fathurrohman, M., et al. (2016). Teachers' readiness in using mobile devices for mathematics teaching and learning: A case study in Banten province, Indonesia. In D. Churchill & M. Notari (Eds.), Proceedings of the international mobile learning festival 2016: Mobile learning, emerging learning design & learning 2.0 (pp. 103–121). Hong Kong: CIHCD.

Today. (2015, February 11). Smartphone penetration in Singapore the highest globally: Survey. *Today.* Retrieved from http://www.todayonline.com/singapore/smartphone-penetration-singapore-highest-globally-survey.

Traxler, J., & Kukulska-Hulme, A. (Eds.). (2016). *Mobile learning: The next generation*. New York: Routledge.

Tuliao, D. P., Duldulao, T. J., Pagtaconan, W. C., & Galang, A. A. (2015). Development of a mobile learning application for kindergarten: Process, issues and challenges. *International Journal on Open and Distance Learning, 1*(1 & 2), 15–25.

Ulfa, S. (2013). *Implementing mobile assisted language learning in rural schools for enhancing learning opportunity.* Paper presented at the Asian Conference on Education, Osaka, 23–27 Oct.

UN. (2015a). The millennium development goals report. New York: United Nations. Retrieved from http://www.undp.org/content/dam/undp/library/MDG/english/UNDP_MDG_Report_2015.pdf.

UN. (2015b). *World population prospects: The 2015 revision. Key findings and advance tables.* New York: United Nations. Retrieved from https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf.

UNDP. (2016). *Human development report 2016: Human development for everyone.* New York: United Nations Development Programme. Retrieved from http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf.

UNESCO. (2015a, March 25). Ministry of Education and UNESCO jointly prepares strategic plan for the development of Myanmar's education management information system. UNESCO. Retrieved from http://en.unesco.org/news/ministry-education-and-unesco-jointly-prepares-strategic-plan-development-myanmar-s-education.

UNESCO. (2015b, June 30). UNESCO partners with Ericsson to launch an ICT for education project in Myanmar. UNESCO. Retrieved from http://en.unesco.org/news/unesco-partners-ericsson-launch-ict-education-project-myanmar.

UNESCO Bangkok. (2015, December 9). Myanmar takes leap forward in ICT in teacher education reforms. UNESCO Bangkok. Retrieved from http://www.unescobkk.org/education/news/article/myanmar-takes-leap-forward-in-ict-in-teacher-education-reforms/.

UNESCO Bangkok. (2016, July 12). Mobile literacy for out-of-school children project in Thailand (Microsoft, true cooperation [sic] and MOE Thailand). UNESCO Bangkok. Retrieved from http://bangkok.unesco.org/content/mobile-literacy-out-school-children-project-thailand-microsoft-true-cooperation-and-moe

UPOU Trailblazers. (2015, May 13). Using mobile computers in basic education. UPOU Trailblazers. Retrieved from http://www.upou.edu.ph/2015-06-24-16-23-38/upou-trailblazers/33-using-mobile-computers-in-basic-education.

Valk, J., Rashid, A., & Elder, L. (2010). Using mobile phones to improve educational outcomes: An analysis of evidence from Asia. *International Review of Research in Open and Distance Learning, 11*(1), 117–140.

Veedvil. (2016, March 16). สถิติผู้ใช้งาน mobile และจำนวน smartphone ของ ประเทศไทยปี 2015. *Veedvil.* Retrieved from http://www.veedvil.com/news/mobile-users-and-smartphone-in-thailand-2015/.

Wang, T., & Towey, D. (2012). A rethinking of digital learning device projects. In M. J. W. Lee & H. V. Leong (Eds.), Proceedings of IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE) 2012. IEEE. Retrieved from http://ieeexplore.ieee.org/document/6360298/.

We Are Social. (2017). Digital in 2017: Eastern Asia. *SlideShare.* Retrieved from https://www.slideshare.net/wearesocialsg/digital-in-2017-eastern-asia.

WeChat. (2016, December 29). The 2016 WeChat data report. *WeChat Chatterbox.* Retrieved from http://blog.wechat.com/2016/12/29/the-2016-wechat-data-report/.

Widiartanto, Y. H. (2016, October 24). Pengguna internet di Indonesia capai 132 Juta. *Kompas.com.* Retrieved from http://tekno.kompas.com/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta.

Wong, L.-H., & Looi, C.-K. (2011). What seams do we remove in mobile-assisted seamless learning? A critical review of the literature. *Computers & Education, 57*, 2364–2381.

Wong, L.-H., Chai, C.-S., Chin, C.-K., Hsieh, Y.-F., & Liu, M. (2012). Towards a seamless language learning framework mediated by the ubiquitous technology. *International Journal of Mobile Learning and Organisation, 6*(2), 156–171.

Worldometers. (2017). Thailand population (live). *Worldometers*. Retrieved from http://www.worldometers.info/world-population/thailand-population/.

Yamada, T. (2015). MOOC phenomena in Japan: JMOOC and OUJ-MOOC. In B. Kim (Ed.), *MOOCs and educational challenges around Asia and Europe* (pp. 35–48). Seoul: KNOU Press. Retrieved from http://asemlllhub.org/fileadmin/www.asem.au.dk/publications/MOOCs_and_Educational_Challenges_around_Asia_and_Europe_FINAL.pdf.

Yuliani, R. E. (2010). Pengembangan mobile learning (m-learning) sebagai model pembelajaran alternatif dalam meningkatkan minat dan kemampuan siswa terhadap Matematika. *Jurnal Pendidikan MIPA, 1*(1), 52–61.

Zhang, K. (2008). Ubiquitous technology for language learning: The U-Japan movement in higher education. *Journal of Computing in Higher Education, 20*(2), 81–91.