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NOKIA

MOBILE LEARNING FOR TEACHERS IN LATIN AMERICA

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

TEACHER FOCUS

UNESCO Working Paper Series on Mobile Learning

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ABOUT THE SERIES

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

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

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

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

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

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ABSTRACT

This paper reviews and compares the most relevant ongoing initiatives on the use of mobile phones to support teachers and improve teaching practices in Latin America. Three major projects were identified that aim to provide in-class support for teachers via mobile phones. The paper analyses these projects in depth to determine key factors for success, sustainability and growth. An additional eighteen initiatives were found that used different mobile technologies, were short-term or small in scale, or focused on learning outside the formal school system. The paper describes each of these projects in brief and compares their most salient features.

The three major projects are Puentes Educativos in Chile, Raíces de Aprendizaje Móvil in Colombia, and Entorno Móvil Interactivo de Aprendizaje (EMIA-SMILE) in Argentina. The first two projects have roots in the same international programme, and both aim to improve student learning in mathematics, science and English. Using smartphones with wireless internet connectivity and data projectors, teachers download and screen educational videos for students in class and then teach around the videos. The projects include a teacher training programme that aims to transform traditional pedagogy by encouraging teachers to use digital resources to make learning more interactive and student-centred. The third project aims to improve students' writing and scientific thinking skills by using smartphones connected to a local network to support inquiry-based learning. Students work in groups to create, post and answer questions about a specific topic. Teachers monitor the activity from a laptop computer and use real-time feedback from students to lead class discussions and design follow-up activities tailored to students' individual needs.

While most of the initiatives identified focus mainly on developing educational software and content for mobile devices, the three major projects emphasize specific methodologies and pedagogical practices, which are supported by digital content and software. In the EMIA-SMILE project, the methodology – in this case inquiry-based learning – is embedded in the software, so that the technology itself intrinsically supports and reinforces new teaching techniques. This kind of close alignment between pedagogy and technology seems to ensure the best results, especially when projects are scaled up.

An analysis of the three main projects as well as other initiatives in the region reveals a number of factors necessary for project sustainability and growth. These include local and international partnerships, cost-reduction strategies and a comprehensive implementation plan that considers technology, methodology, digital content, local curriculum, and teacher training and support. These success factors are consistent with the lessons learned from previous information and communications technology (ICT) in education initiatives in the region. The main barriers to mobile learning also echo difficulties encountered by prior ICT programmes. Although mobile phones are less expensive than laptop computers, high cost is still the major impediment to mobile learning efforts in Latin America. Because smartphones and internet connectivity are relatively expensive in the region, it is worth considering initiatives that use the standard mobile phones and network connections already available to most students and teachers in Latin America.

BACKGROUND

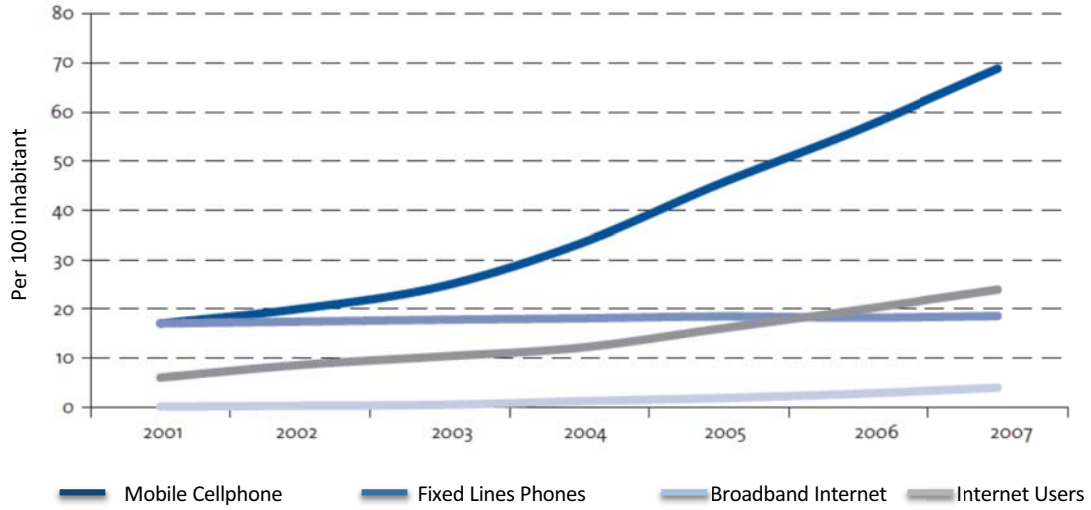
Latin American countries have made important progress in education since the 1990s. Access to primary education is close to universal and in the last decade there has been a significant increase in access to secondary education, from 59% in 1999 to 73% in 2009 (Klein, 2011). Nevertheless, the region still faces significant challenges related to quality, efficiency and equity in its educational systems.

In this context, ICT has been integrated into the region's educational reform agendas with the goal of improving the quality of teaching and learning and increasing access to education for all students. As a result of two decades of public policies that were specifically aimed at providing technology to the educational system, in 2009 more than 90% of secondary students in Latin America had access to ICT at school (Claro et al., 2011). Alvariño and Severín (2009) identified three stages in the development of ICT initiatives in the region during this period. In the first stage, ICT programmes were aimed at providing infrastructure, mostly through the installation of computer labs. In many cases, this stage included training in basic ICT skills for teachers and students, who usually did not have access to computers outside of school. With the emergence of the internet in the mid-1990s came a second stage where interventions expanded to include other initiatives, such as providing connectivity and offering digital content that could support schoolwork. In the third stage, which began in the early 2000s, web-based education portals appeared, providing educational content relevant to national curricula. During this stage, teacher training and professional development programmes also started to include pedagogical support to help teachers integrate ICT into their teaching practices.

Several studies have indicated that while many teachers in Latin America have developed the skills to use new technologies, they have not yet translated these skills into innovative practices in the classroom (Cuban, 2001; Law et al., 2008; Trucano, 2005). This may be due in part to the fact that most schools in Latin America have computers installed in labs rather than individual classrooms, making it more difficult to integrate ICT into regular lessons and activities. Teachers must book computer access in advance and move their classes to a separate room for a limited period of time, which, as Watson argues, 'does not allow for open-ended exploratory work which the technology can facilitate, but which demands flexibility' (2001, p. 257). As a solution to this problem, many countries in the region have adopted 1:1 (one laptop per student) programmes, which provide each student and teacher with a laptop or netbook to use at school and sometimes at home as well. These programmes aim to bridge the 'digital divide' between rich and poor students and to support innovations in teaching and learning (Means, 2000; Watson, 2001). A 1:1 environment offers teachers far more flexibility when incorporating ICT into their classroom practices and facilitates more self-directed and student-centred learning, as activities can be personalized based on students' individual interests and needs. Interacting directly with educational resources on their own computers both in and outside of school may also increase students' motivation and investment in their education. Four Latin American countries – Uruguay, Argentina, Venezuela and Peru – have implemented national 1:1 programmes, and smaller pilot programmes have been launched in several provinces and municipalities throughout the region.

The main drawback to 1:1 programmes is the high cost of equipment. Recently some educators and policy-makers in the region have begun to explore the potential of mobile learning – learning using mobile technologies – as a less expensive alternative to 1:1 laptop programmes. Mobile devices, including standard mobile phones as well as smartphones, have become increasingly widespread in Latin America (see Figure 1). According to the Fundación Telefónica (2008), 83% of 10–18-year-olds in the region have mobile phones, and the percentage of adults who own mobile phones is comparable. Unlike computers, which tend to be prohibitively expensive for all but the region's wealthiest inhabitants, mobile phones are affordable for the majority of the population.

Figure 1. Latin American ICT Development 2001–2007



Source: Fundación Telefónica, 2009

The use of mobile phones in education has the potential to make learning more accessible, collaborative and relevant. As a low-cost substitute for computers, mobile phones can increase access to the internet and digital educational content, and because the devices are portable, they can facilitate learning outside as well as inside schools. The proliferation of social media has also created new opportunities for collaboration through mobile technologies, which can be leveraged for educational purposes. Finally, because so many people currently own mobile devices, encouraging students to use them for learning could make education more relevant, especially in an age where the ability to access and make sense of information is an increasingly vital life skill. Though still in the early stages of development, mobile learning has begun to spread in Latin America, and a number of mobile learning projects have been launched in recent years.

Given the wide distribution of mobile phones, it is likely that most teachers in Latin America currently own a mobile device and feel comfortable using it. This represents an opportunity for education leaders and policy-makers to initiate programmes that promote the use of mobile technologies to support teachers and improve practice. Such initiatives have the advantage of utilizing a technology that is already in place and widely used, greatly reducing the investments required for equipment, training and technical support. Several of the current mobile learning projects in Latin America are aimed specifically at improving pedagogy and increasing support for teachers. The main objective of this paper is to review the most relevant of these projects from a comparative perspective. Through analysis of the various

programmes, the paper aims to identify trends and draw conclusions that can inform the development of future mobile learning initiatives in Latin America and elsewhere.

For the purposes of this paper, mobile learning is defined as learning that is facilitated by mobile phones, either alone or in combination with other technologies. Other mobile devices, such as tablet computers, were excluded from this review because of their higher cost and limited availability in the region. Additionally, the paper uses a broad definition of 'teacher': namely, any adult who has teaching responsibilities, irrespective of formal qualifications or employment status. While this review does not completely exclude postsecondary teachers, it concentrates mainly on initiatives designed to support teaching and learning at the primary and secondary education levels. The paper surveys projects created to enrich professional development as well as those aimed at improving classroom pedagogy and, by extension, student learning.

METHODOLOGY

Data for this paper were collected in late 2011 and early 2012. The mobile learning initiatives reviewed in the paper were identified and sorted through a three-step process. First, internet searches and consultations with thirty regional education experts – primarily academics and policy-makers – were used to create an inventory of relevant mobile learning initiatives in the region. Next, current initiatives were categorized by their main characteristics, including programme objectives, the types of technology used, pedagogical approach and target population. Finally, the collected information was analysed to identify common strategies, strengths and weaknesses.

The main focus of this paper is on mature and large-scale mobile learning projects. Rather than amass information about newly-launched programmes for which there is generally little information and data to draw on for analysis, this paper highlights projects that have passed the initial, exploratory stages, are operating in more than one school and have plans to expand. These projects are expected to offer more useful information for policy-makers than projects that have not yet moved out of the pilot stage.

Finally, because no mobile learning initiatives could be identified in the Caribbean, this paper focuses solely on mobile learning in Latin America.

MOBILE LEARNING INITIATIVES

Research for this paper identified twenty-one mobile learning initiatives in Latin America related to teacher support and pedagogy in and outside the classroom. Three of these are mature, ongoing projects with identifiable plans to expand in the near future. These projects will be analysed in depth in the following sections, while the remaining projects will be discussed in less detail. Table 1 lists all of the projects identified; the first three are those selected for deeper analysis. For additional information on all of the identified initiatives, see Appendix B.

Table 1. List of initiatives identified

Nº	Project/Initiative	Country	Description
1	**Puentes Educativos**	**Chile**	**Teachers use smartphones to present educational videos to the class.**
2	**Raíces de Aprendizaje Móvil**	**Colombia**	**Teachers use smartphones to present educational videos to the class.**
3	**EMIA-SMILE**	**Argentina**	**Students use smartphones to participate in an inquiry-based activity in the classroom.**
4	Celumetraje	Argentina	Students use mobile phones to record video scenes for a short film.
5	Edumóvil	Mexico	Students use applications on mobile devices to learn math, Spanish, science and history.
6	ViDHaC2	Chile	Students use educational video games on mobile phones for self-directed learning in science within a school context.
7	Eduinnova	Chile	Students use netbook computers to participate in a collaborative activity in the classroom.
8	PocketSchool	El Salvador	Children use mobile devices to access electronic books and educational games for self-directed learning outside of a school context.
9	PSU Móvil	Chile	Students use their mobile phones to access practice exercises and content for the national university admissions test.
10	Evaluación de Aprendizajes a través de Celulares	Paraguay	Students take a national assessment through their mobile phones at school.
11	BlueGénesis	Colombia	University students use mobile phones with Bluetooth to exchange information with professors and peers.
12	M-iLab	Mexico	University students use iPhones to learn about physics.
13	Postítulo de Especialización Superior en Educación a Distancia	Argentina	University students use BlackBerry devices to access content and activities for a blended learning course.
14	Aprendizaje Móvil Project at ITESM	Mexico	University students use BlackBerry devices to access course content and activities.
15	Proyecto Facebook	Argentina	University students use mobile phones to record video scenes for a short film.
16	Blackboard Mobile Learn+	Mexico	University students use iPhones and other Apple devices with a mobile version of Blackboard LMS to access course contents and activities.
17	Kantoo	Multiple countries	The general public can use mobile phones to access English lessons (paid service).
18	Programa Nacional de Alfabetización	Colombia	Illiterate youth and adults use a mobile phone with a special SIM card to take a public literacy course.

Nº	Project/Initiative	Country	Description
19	PreveMóvil	Honduras	Young people receive text messages on their mobile phones with information and tips to prevent the spread of HIV/AIDS.
20	Educación Móvil Continua en la Salud	Peru	Health workers receive text messages on their mobile phones to update their professional knowledge.
21	DatAgro	Chile	Small-scale farmers receive text messages on their mobile phones about the agricultural market, weather and news.

As is evidenced by the project descriptions above, there is significant diversity among mobile learning initiatives in Latin America. However, it is important to clarify that mobile learning projects aimed at supporting teachers and teacher development are extremely rare, and information about such work is scarce. Most of the experts consulted were not able to identify specific mobile learning initiatives for teachers, and only one or two could provide concrete information about ongoing projects. Also, most of the online information about identified projects was out of date, with media presence sometimes limited to a single reference in the news. An additional problem was the lack of evaluation or data on project results for all but one of these initiatives. It seems that most of the initiatives in this field are still in an exploratory stage: pilot projects, short-term university research, or single, school-based innovations developed by one or two teachers. Consequently, most of the initiatives identified are being implemented on an extremely small scale and are usually experimental in focus. It is also important to mention that despite consulting Brazilian experts and conducting extensive internet searches in Portuguese as well as in Spanish, researchers were not able to find relevant projects in Brazil. This does not mean that such projects do not exist; it is certainly possible that significant school-based initiatives were left out of this review because they do not have any online or media presence. In spite of these limitations, the group of initiatives identified is illustrative of the types of mobile learning projects emerging in Latin America.

MOBILE LEARNING FOR TEACHERS: Three major projects

Of the twenty-one mobile learning initiatives identified, three projects were deemed the most important and relevant to teacher support and pedagogy: Puentes Educativos (Educational Bridges) in Chile, Raíces de Aprendizaje Móvil (Roots of Mobile Learning) in Colombia, and Entorno Móvil Interactivo de Aprendizaje (Mobile Interactive Learning Environment) in Argentina.

The first two projects – Chile's Puentes Educativos and Colombia's Raíces de Aprendizaje Móvil – have their roots in the same programme, though the implementation differs in each country. Both projects were developed by BridgeIT, an international, multisector partnership founded by Nokia, the Pearson Foundation, the International Youth Foundation (IYF) and the United Nations Development Programme (UNDP). BridgeIT collaborates with local partners, including governments and non-profit organizations, to bring interactive, multimedia education programmes to schools around the world (Pearson Foundation, 2011). While both Latin American BridgeIT projects have the support of national institutions, the responsible agencies for each project are very different. In Chile the project is led by an educational non-governmental organization (NGO) – the Asociación Chilena Pro Naciones Unidas (Chilean

Association for the United Nations, ACHNU) – and has been implemented in more than 200 schools since it began in 2010. The Colombian project, launched in 2011, is being led by the Ministry of Education as a national pilot programme, with initial implementation planned for seventy-five schools (CVNE, 2011). As will be discussed in the analysis section, these differences have significant implications for project scale and sustainability.

Both BridgeIT projects aim to improve teaching and learning in mathematics, science and English language through the use of multimedia resources. The projects provide teachers with smartphones that they can use to access an extensive library of educational videos. In some cases internet service for downloading the videos is also subsidized. Teachers participate in an eight-day workshop on how to manage the video library through their mobile phones and incorporate the videos into their instruction. Workshop leaders help teachers design and customize lesson plans for the entire school year. The plans typically include a weekly presentation of a short educational video from the project's library, which teachers download to their smartphones and screen for their classes using a data projector. Teachers are expected to use these videos to introduce lesson topics and illustrate key concepts in a way that engages students and helps facilitate comprehension. Other lessons for the week include student discussion and collaboration, practical activities for students to apply what they have learned, and opportunities for teachers to assess student learning and provide feedback. Overall, the projects encourage a student-centred approach to education, and it is assumed that teachers will use the videos to stimulate participation and promote interaction in their classrooms.

The two projects also have well-structured teacher support strategies. In the middle of each year, teachers attend a one-day workshop focused on reinforcing pedagogical and technological skills and resolving any issues that teachers might be facing as they implement their lesson plans. Programme specialists also visit teachers twice a year to provide more personalized support. In addition to this, the Colombian project, Raíces de Aprendizaje Móvil, has established an online 'coaching community' where teachers can access information about BridgeIT, share experiences, ask questions, express concerns and post solutions to problems. The Colombian programme organizers also hope to provide a text messaging service through which teachers can receive useful information for their classes. If this service is implemented, it will be the first example of using mobile phones to deliver professional development content to teachers in Latin America.

Both BridgeIT projects are designed to provide teachers with high-quality educational content, lesson plans, training and support. The videos developed for the projects can be powerful educational resources if teachers have a meaningful strategy for using them in class. The accompanying lesson plans, which teachers tailor to their curriculum during the programme's initial workshop, contain detailed information about strategies and best practices for using the videos to maximize student learning. While the projects are well-designed, a preliminary evaluation of Puentes Educativos in Chile revealed several problems in the implementation phase (Román, 2012). The evaluation, which was conducted by a local university in 2011, found that although 75% of teachers claimed to be using the projects' lesson plans and 65% said they used the videos, few of them actually integrated the videos into their lessons in a way that reinforced conceptual understandings or encouraged student interaction. Instead, most of the teachers screened the videos only at the beginning of class to pique students' interest in the lesson topic. No evaluative information is currently available on Colombia's

Raíces de Aprendizaje Móvil, so it remains to be seen whether this programme faces similar challenges.

The third major mobile learning project is Argentina's Entorno Móvil Interactivo de Aprendizaje (EMIA) programme, which was developed by Seeds of Empowerment, a non-profit organization funded by Stanford University in the United States and led by Paul Kim, a professor in the university's School of Education. Seeds of Empowerment designs and implements projects that use cutting-edge technology to improve access to education in underserved communities around the world. The EMIA project, also known as EMIA-SMILE, is based on the Stanford Mobile Inquiry-based Learning Environment (SMILE), a mobile learning platform developed through a university research project. The programme provides schools with smartphones for students and a wireless router for local networking. In Argentina, EMIA-SMILE is led by Telecom, the major local telephone company for the northern part of the country, and supported by the provincial Ministries of Education in Misiones and Buenos Aires. The project began in 2011 in one school and has plans to reach twenty low-income schools by the end of 2012.

The EMIA-SMILE project aims to cultivate critical thinking, creativity, reading and writing skills, and a scientific attitude in students through inquiry-based learning. Rather than listening to lectures and memorizing information, students actively engage with subject material by generating their own questions and research activities to deepen their knowledge and understanding. To facilitate this type of learning, the project employs collaborative and interactive strategies. Using smartphones and the SMILE software, students work in groups to create questions about the topic they are studying and then use the questions to assess their classmates' knowledge.

For example, a biology teacher who has just presented students with new content might ask students to gather in groups of three to discuss what they have just learned and develop questions for the rest of the class. Each group uses a smartphone to capture images or record video to support questions with visual representations. Using the SMILE application on the smartphone, the groups post their questions, which are compiled and sent to other groups in the class. Students answer questions posted by other groups and also rate the quality of each question. The SMILE application sends questions, rankings and results to the teacher's laptop in real time, so that while students are engaged in this activity, the teacher can track student progress and see which questions students prefer and which are giving them the most difficulty. As a final step, the whole class comes back together to discuss answers and evaluate the questions with the teacher. The activity can be made into a competition by declaring the group that formulated the question with the best evaluation the 'winners'.

The project also includes a training component to ensure teachers know how to use the SMILE method and technology. At the beginning of the programme, participating teachers attend a two- or three-day workshop, where a trainer introduces the SMILE platform and walks teachers through designing and implementing an example activity. In addition to this initial workshop, the project provides teachers with continuous support through weekly meetings and online assistance.

The EMIA-SMILE project is a good example of a research-based initiative that was able to go beyond the experimental stage by building up alliances with local partners and carefully planning its implementation. The project provides teachers with an effective methodology and

a well-designed technological platform that supports the application of the methodology in the classroom. However, the project's teacher training strategy seems insufficient, perhaps because the project managers are overly confident that the inquiry-based methodology is embedded in the software. Another weakness of the project is the need to purchase smartphones for students. In Latin America this can impose a financial burden that limits a project's ability to grow.

OTHER MOBILE LEARNING INITIATIVES

The following sections briefly review the other eighteen mobile learning initiatives selected for this paper. Although these programmes are diverse, they help illustrate some of the overall approaches emerging in the field of mobile learning. The initiatives focus on learning both in and outside of school and vary in terms of their target audiences, the mobile technologies they employ, and the project's size, scope and duration.

SCHOOL-BASED INITIATIVES USING MOBILE PHONES

Three of the initiatives identified focus on the use of mobile phones in schools to enhance teaching and learning. All of the projects are small-scale, limited to a few teachers and schools. The first project, called Celumetraje, was launched in Argentina in 2009 by a single teacher who had no relationship with any larger regional or national mobile learning programme. The project sought to develop students' technological skills while having them work collaboratively in groups to direct and publish short films using built-in video cameras on mobile phones. Students planned the films, recorded scenes with mobile phones, transferred video files to computers, used computer software to edit the films, presented the films to the class using a digital projector and, finally, uploaded the films to the internet.

A review of mobile learning projects in Latin America suggests that many of them begin like Celumetraje, in the classrooms of innovative teachers who feel very comfortable with mobile technologies and want to explore ways of using mobile devices to motivate students and advance student learning. It is highly probable that there are many other similar projects unfolding in Latin America, but because they are so small they are rarely documented in policy papers or news stories. Because programmes like Celumetraje are essentially 'off the radar', education leaders and policy-makers tend not to be aware of them. Yet these types of contexts – the individual schools and classrooms where teachers have the flexibility to experiment with mobile learning – are likely to be the places where the most innovative activities are taking place.

The second project, Edumóvil, is a long-term research programme at the Universidad Tecnológica de Mixteca (Technological University of Mixteca) in Mexico that began in 2003 and has been supported by Motorola, a telecommunications company based in the United States, since 2007. Aimed at improving teaching and learning at the primary-school level through the use of mobile technologies, the programme develops mobile learning applications which are tested in schools to assess their impact. The school implementations are always small and short-term, with no opportunities for scaling up. The applications

designed range from video games and simulations to collaboration platforms, and they tend to be more focused on increasing student engagement and motivation than on facilitating specific pedagogical approaches, like the EMIA-SMILE programme. Although the project managers say that Edumóvil promotes collaborative learning by fostering teamwork and interaction among students and strengthening social relations, the information about the different applications gathered for this review was not consistent with this claim. Some of the applications emphasized learning through collaboration but others were only focused on reinforcing concepts and skills through individual exercises. The programme is divided into specific research projects for different school subjects; so far Edumóvil has developed mobile learning applications for Spanish, mathematics, history and natural science.

The third project, Videojuegos para el Desarrollo de Habilidades en Ciencia a través de Celulares (Video Games for Developing Science Skills through Mobile Phones, ViDHaC2), was a short-term research project at the Universidad de Chile (University of Chile) that developed educational video games for primary-school students learning science. The games could be played on mobile devices to support self-directed learning in a school-activity context. Research was conducted over a period of three months in five schools, where students participated in two different activities in which they used video games on mobile phones to learn about a science topic. The project also produced a computer editing program that allowed teachers to easily design science video games for their students. Of all the initiatives identified, ViDHaC2 is the only one that enabled teachers to create original content that students could access from mobile devices.

SCHOOL-BASED INITIATIVES USING OTHER MOBILE TECHNOLOGIES

The list of initiatives identified also includes two large-scale, school-based projects that use mobile technologies other than mobile phones to support teaching and learning. The first project is Eduinnova, a long-term research programme at the Pontificia Universidad Católica de Chile (Catholic University of Chile) that has developed mobile technology platforms to support collaborative activities in the classroom. The Eduinnova project uses a 1:1 model, providing each student in the class with a netbook. The students are asked to work in groups of three to answer a sequence of questions presented on their netbooks, while the teacher follows the activity on his or her own laptop. Eduinnova has a substantial teacher development programme. Over the course of one semester, teachers participate in seven sessions on how to use the project's methodology, software and curricular resources. The training plan also includes practical activities with the software and some peer support sessions in the classroom. Additionally, the project managers work closely with schools to respond to teachers' everyday needs while implementing the programme. Eduinnova also has a well-structured strategy for scaling up, which has allowed the project to expand to approximately 100 schools in Chile and 55 schools in other countries in South America.

The Eduinnova software is very similar to the SMILE platform used by the EMIA-SMILE project in Argentina. Both programmes have developed a technological system that helps teachers encourage collaborative learning in the classroom. In both projects, groups of three students work together to answer questions using a mobile device, while the local network allows the system administrator – usually the teacher – to coordinate and follow the students' work using a laptop. In spite of using similar technologies and group work, however, the programmes differ in their pedagogical approach. The methodology that drives EMIA-SMILE emphasizes

inquiry-based learning, asking students to generate their own questions about the subject matter. By contrast, Eduinnova focuses on collaborate learning, asking students to answer teacher-generated questions with the help of their peers. Although students work together in both projects, the primary focus of EMIA-SMILE is on students formulating their own questions, whereas the central focus of Eduinnova is collaboration with peers. It is also interesting to note that the Eduinnova project initially employed hand-held mobile devices like Pocket PCs, but the high cost of these devices made it difficult to expand the programme. As a result, the Eduinnova designers decided to switch to netbooks, which were (and in many instances still are) cheaper than smartphones. This example shows that the strategies and software used by both Eduinnova and EMIA-SMILE can be tailored to a variety of mobile technologies, with the ultimate decision usually based on price.

The second large-scale, school-based project using devices other than mobile phones is PocketSchool, an initiative that aims to support children from isolated rural areas who lack access to regular educational services. Like EMIA-SMILE, PocketSchool is a Seeds of Empowerment project designed and founded by professor Paul Kim at Stanford University's School of Education in the United States. The project provides students with a Stanford-designed mobile device called TeacherMate, similar to Nintendo's Game Boy, which can be used to read digital books and play educational games to develop literacy and math skills. Since 2007 the project has been implemented in many countries in Asia, Africa and Latin America. Most recently a PocketSchool project has been launched in El Salvador, where it is led by the Universidad Tecnológica de El Salvador (Technological University of El Salvador, UTEC). The programme is similar to the early version of Eduinnova, which used a similar device to teach math through educational games, but PocketSchool has not expanded since its outset to include additional schools in El Salvador.

OUT-OF-SCHOOL INITIATIVES

All of the school-based initiatives described above aim to provide new resources to support and enrich classroom teaching. In contrast, the following mobile learning projects are being used to supplement traditional classroom-based approaches by increasing the opportunities for learning outside of the school environment. This review identified thirteen initiatives that focus on using mobile technologies for out-of-school learning. These initiatives present a variety of approaches, scopes and objectives. Some have limited duration while others are open-ended and ongoing, and some target a very specific group of learners. It is possible to categorize this pool of diverse initiatives into four groups, based on their target populations: (1) initiatives aimed at secondary-school students; (2) initiatives aimed at university students; (3) initiatives that target members of the general public, both children and adults; and (4) initiatives designed to help workers access information relevant to their jobs.

SECONDARY-SCHOOL STUDENTS

In the first group are two initiatives focused on the assessment of secondary-school students. Chile's PSU Móvil is an open service from Educarchile, the state-funded education portal, that uses a mobile phone application and email to send practice exercises and content to students preparing for the Prueba de Selección Universitaria (University Selection Test, PSU), the national test for university admission. The service started in 2008 and is widely used; about 7,500 exercise packs are downloaded each year. Paraguay's Evaluación de Aprendizajes a

través de Celulares (Learning Assessment through Mobile Phones) was a pilot project implemented by the Ministry of Education and Culture to assess student learning in Spanish and mathematics using mobile phones. In March 2011, approximately 10,000 students in 300 secondary schools throughout the country took the exam on their mobile phones. Students received multiple-choice questions via text message and texted their answers as replies, which were sent directly to the Ministry of Education's database. In the second phase of the pilot, additional tests were used to monitor student progress later in the semester and at the end of the year. Assessment results and evaluative information about the project have not yet been made available to the public.

UNIVERSITY STUDENTS

Six of the out-of-school initiatives are focused on university students. Two of these projects were created by individual university professors to reinforce course concepts or develop students' ICT skills. In Mexico, a physics professor at the Instituto Tecnológico y de Estudios Superiores de Monterrey (Monterrey Technological and Higher Studies Institute, ITESM) developed Mobile Intelligent Laboratory (M-iLab), a mobile application for Apple iPhones, to illustrate the physics theory of simple harmonic motion and momentum. With the application, the device itself becomes part of a physics experiment: when the phone is moved in particular ways (hung like a pendulum, for instance), the motion detection software registers the movement and records it on an XYZ graph for further analysis. In Argentina in 2008 and 2009, a professor at the Universidad de Buenos Aires (University of Buenos Aires, UBA) developed the Proyecto Facebook (Facebook Project), a participatory learning experience. As part of the project, students used mobile phones to record and upload short videos. This initiative is similar to Celumetraje only at the university level, as both projects aim to engage students in the course and develop their technological skills by having them record videos using mobile phones.

The other four university-based initiatives use mobile phones to extend education to virtual spaces, enabling more frequent communication between teachers and students. These spaces are usually supported by a platform called a Learning Management System (LMS) or Virtual Learning Environment (VLE) that students can access via computers or smartphones to view course information, download materials, upload assignments and participate in course activities such as chats and forums. These initiatives are interesting examples of how mobile learning can be used to expand educational opportunities beyond the set time and location of a traditional class. The fact that these types of initiatives appear only at the university level may be due to the greater level of autonomy and responsibility they require, which can be expected of university students.

The first of these projects, BlueGénesis, is an academic platform created in 2008 by a professor at the Universidad de los Andes (University of the Andes) in Colombia. The programme uses mobile phones with Bluetooth technology to support communication and the exchange of information and course contents between teachers and students throughout the university. Using Bluetooth connectivity, teachers send questions, tests, course materials and messages to students' mobile phones from their laptops. Students can read materials, answer questions and receive feedback on their mobile phones. The second project, called Aprendizaje Móvil (Mobile Learning), was implemented in 2007–2008 at ITESM in Mexico. Students in the programme used BlackBerry mobile devices to access videos, audio files and exams, and to communicate with their teachers and classmates. The third project, also

implemented at ITESM, is Blackboard Mobile Learn+, which began in 2010. The programme uses the Blackboard Learning Management System (LMS) to allow students to access course content and activities from their iPhones. Finally, the Postítulo de Especialización Superior en Educación a Distancia (Higher Postgraduate Specialization in Distance Education) programme at the Universidad del Salvador (University of the Saviour, USAL) in Argentina enables students to use their BlackBerry devices to access course content and activities in a specific blended-learning graduate course. Whereas the first three initiatives are university-wide projects, this last project is limited to only one course.

GENERAL PUBLIC

Three of the out-of-school mobile learning initiatives aim to provide literacy, English language and health education to populations or groups of people normally out of reach of formal institutions. First, Kantoo is a paid service offered in various countries that uses mobile phone applications and text messages to teach English. Second, Colombia's Programa Nacional de Alfabetización (National Literacy Programme) includes plans for a basic literacy course that will be delivered by the Ministry of Education through mobile phones. Lastly, the PreveMóvil project aims to prevent the spread of HIV/AIDS among young people in Honduras by sending relevant information and advice via text messages.

WORKERS

Finally, two initiatives take advantage of mobile technologies to send information to workers to help them better perform their jobs. The Educación Móvil Continua en Salud (Mobile Continuing Health Education) in Peru aims to update health workers' professional knowledge by sending key information via text messages to their mobile phones. Similarly, the DatAgro project sends text messages with relevant and useful information, including market prices and weather reports, to small farmers in Chile.

COMPARATIVE ANALYSIS OF INITIATIVES

The following sections analyse the various Latin American mobile learning initiatives described above. The initiatives were evaluated based on their objectives and target populations, the circumstances under which they were developed and the role of mobile technology in each project. Each section below discusses and compares the initiatives' approaches, strengths and weaknesses as well as the lessons they offer future programmes. Although the analysis will concentrate on the three main projects identified, other initiatives will also be considered in order to provide a wider picture of the region's mobile learning efforts.

OBJECTIVES AND TARGET POPULATIONS

The three major initiatives identified – the two BridgeIT projects and the EMIA-SMILE initiative – share ambitious educational and social goals. For all three projects, the main objective is educational: they promote the transformation of teaching and learning by providing new digital resources and shifting traditional pedagogy toward more student-centred, collaborative or inquiry-based learning. Through these interventions, the programmes aim to improve students' subject-learning as well as their higher-order thinking skills such as creativity, problem-solving and critical thinking.

In addition to providing digital resources, all three of these initiatives attempt to fundamentally change teaching practices. In fact, the main component of the two BridgeIT projects is training teachers to plan lessons that encourage more interactive and student-centred learning. The educational videos provided by the project are used to support this pedagogical shift, but they are not the centre of the programme strategy. Similarly, the EMIA-SMILE project is based on the principle of inquiry-based learning. The smartphone application designed for the project is intended to facilitate lessons and activities based on this principle, but the technology itself is only useful if the teacher embraces the methodology it supports. The Eduinnova initiative also uses mobile technologies to encourage a pedagogical shift, through a programme that focuses on collaborative learning with netbooks. It seems that these projects' designers have learned from the examples of previous ICT initiatives in the region, which demonstrated the importance of providing teachers with a pedagogical framework to guide the use of new digital resources and technologies. Studies have consistently shown that merely introducing technology and digital resources alone, without a solid strategy for changing pedagogy, does not result in improved educational outcomes for students.

Nevertheless, these initiatives have been less effective than expected in changing teaching practices. The 2011 evaluation of Puentes Educativos, the BridgeIT project in Chile, showed that few teachers leveraged the educational videos to make classes more interactive, using them only as motivational or introductory resources at the beginning of class. Indeed, without interactive follow-up activities, watching videos is not an active experience on its own for students. Teachers using traditional pedagogical methods may be very comfortable incorporating videos into their classes to reinforce key concepts without necessarily wanting

or knowing how to use the videos to increase student participation and interaction. The training provided by the Puentes Educativos programme seems to have been insufficient to actually transform teaching practices. Though no external evaluation has been conducted for the other BridgeIT project – Raíces de Aprendizaje Móvil in Colombia – it can be assumed that this programme suffers from similar weaknesses in training and teaching outcomes. Similarly, the EMIA-SMILE project seems overly reliant on the technology itself to transform teaching practices, as the programme does not provide teachers with a great deal of training in inquiry-based pedagogy beyond the basic use of the SMILE platform. All three projects would be wise to focus more on training teachers in new pedagogical practices, both initially and throughout the programme.

All three main initiatives claim to target vulnerable and isolated populations, especially in rural areas. Programme directors argue that because of their wide network coverage and low price, mobile phones open educational opportunities that were previously inaccessible for these groups of people. However, currently the three projects have only been implemented in schools that already have access to ICT. The two BridgeIT projects expect teachers to use existing data projectors to screen videos, which indicates that computers are already present at these schools. Likewise, the EMIA-SMILE project relies on internet connectivity already available at the school. In this sense, these initiatives, as well as many of the other projects described in this paper, are not reaching the most vulnerable and isolated communities in the region.

Interestingly, none of the identified mobile learning initiatives focused on providing professional development to teachers. While projects like Educación Móvil Continua en Salud in Peru aim to help people working in a particular field update their professional knowledge, there do not seem to be any equivalent programmes for the teaching profession. One reason may be that teacher education relies heavily on practice and experience. The challenge is not so much to provide teachers with more information but to support effective classroom practices, which usually requires personal communication and interaction. Mobile learning may be useful as a complement to face-to-face strategies in teacher training and development, rather than a substitute.

INITIATIVE ORIGINS, DEVELOPMENT AND SUPPORT

The types of institutions from which initiatives emerge, and the public- and private-sector alliances that allow them to grow, have a significant impact on the scope and scale of the projects as well as the types of technologies used. For example, the EMIA-SMILE, Edumóvil, ViDHaC2 and Eduinnova initiatives all began as university research projects funded by scientific grants, with the aim of exploring how new mobile technologies can support more effective teaching and learning. As a result, these initiatives are mainly driven by technological innovations and academic research, rather than by the educational and social needs of the local communities in which the projects are deployed. The strategies and technologies tend to be cutting-edge but not necessarily affordable, and consequently only a few of these research-based projects have been able to progress beyond the experimental stage and build partnerships in the wider community. The two projects that have managed to expand, EMIA-SMILE and Eduinnova, offer complete strategies that include teacher training,

technology infrastructure, technical support and digital resources. Both projects have been able to gain support and resources from private or public institutions to extend their programmes to other schools. However, expansion on a national level normally requires the support of the Ministry of Education, and so far none of the research-based projects have reached this stage. This may be due to the fact that in the last two decades, Ministries of Education in Latin America have focused mainly on providing schools with internet connectivity, computers and, more recently, netbooks and laptops. It is unlikely that these countries will switch the current focus of their national educational programmes to mobile phones, which have a more limited range of uses, unless there is sound evidence that they are more effective than computers in promoting student learning. This is the reason the Eduinnova programme transferred its platform from hand-held devices to netbooks, which may enable the project to be incorporated into the region's national policies in the future.

In contrast to the university-based initiatives, the two BridgeIT projects were developed by a private mobile phone company working with international non-profit organizations and local partners, including some public institutions. While private-sector support has allowed these programmes to be implemented quickly, this type of support is not necessarily sustainable for the long term. In Chile, local leaders of Puentes Educativos are now concerned with finding funding to continue and expand the project, and they have started conversations with the Ministry of Education about securing national support for the initiative. In Colombia, Raíces de Aprendizaje Móvil began with the Ministry of Education's commitment, probably because the pedagogical use of videos was already part of the national education policy: Colombia created an educational channel on television and the internet several years ago. However, it is still too early to say if ministerial support will be able to move this small-scale project to the national level. It might be that these projects have found larger institutional support because their implementation does not involve significant investments in new devices – only one smartphone per teacher, rather than a smartphone for every student – and because supporting teachers is usually perceived as an efficient strategy for improving education for all students.

It is interesting to note that all of the main initiatives identified use smartphones in lieu of computers, even though computers and internet connectivity were already available at the schools in which the projects were implemented. While it is true that most teachers in the region, particularly in underserved communities, feel more comfortable with mobile phones than with computers, the projects did not utilize any of the phones' basic functions, such as voice communication or text messaging, indicating that they could have been implemented just as easily using the schools' existing ICT infrastructure for significantly less cost. For example, teachers in the BridgeIT programme could have used the school's existing computers with a third-generation (3G) internet connection to download and screen videos, and the EMIA-SMILE project's inquiry-based activities could have been supported by netbooks, which are now widely available in secondary schools in Argentina. It seems that in the case of these particular initiatives, the project designers did not consider the local technological context when choosing the type of mobile device to use, and perhaps decided on smartphones for reasons other than low cost and ease of implementation, as they have claimed. In the case of the two BridgeIT projects, the choice to use mobile phones could have been influenced by the availability of financial support from mobile phone companies rather than educational considerations.

USE OF MOBILE TECHNOLOGIES

The way in which mobile technologies are used differs among the initiatives identified. In the two BridgeIT projects, Puentes Educativos and Raíces de Aprendizaje Móvil, teachers use mobile phones to access multimedia resources. In all of the other initiatives, students are the main users of mobile devices. For instance, in the EMIA-SMILE project, students use smartphones to post, answer and rate questions in a specific inquiry-based activity. In other projects, students use mobile phones to play educational games or simulations, or to receive information in formal or informal learning contexts. Having students interact directly with technology is usually considered more effective in promoting experiential learning and building twenty-first-century digital skills, which may explain why the majority of the initiatives focus on students rather than teachers as the primary users of mobile technologies.

From the information available on mobile learning initiatives in Latin America, it is possible to organize the use of mobile technologies into six main categories:

1. ***Teachers use mobile technologies to access multimedia resources and present them to students in the classroom***
   Examples include Puentes Educativos and Raíces de Aprendizaje Móvil, where teachers use smartphones to access an educational video library, download selected videos and screen them for students through a data projector.

2. ***Students use mobile technologies to participate in collaborative activities***
   Examples include the EMIA-SMILE project, where students follow an inquiry-based learning activity using smartphones, and Eduinnova, where students participate in a collaborative activity using netbooks.

3. ***Students use mobile technologies to collect and share information or multimedia resources***
   Students use the standard tools on mobile phones, such as digital cameras and text messaging, combined with computers and free online services, to capture images, record videos, and upload and share files with the class. Examples include Celumetraje and Proyecto Facebook, where students use mobile phones to record videos that are later edited on a computer and shared on YouTube. Many similar school-based initiatives have been identified by other researchers (see for example Kolb, 2011).

4. ***Students use mobile technologies to play educational games or reinforce key concepts***
   Students use mobile phones to illustrate lessons, practice what they have learned, watch simulations or play educational games, in or outside of the classroom, on their own or as part of a teacher-guided activity. Examples include Edumóvil, ViDHaC2, M-iLab and PocketSchool (though the latter uses a proprietary mobile device rather than mobile phones). All of these projects are focused on developing digital resources such as electronic books (e-books), games, simulations and other educational software to be used independently by students, in a classroom environment or extracurricular setting.

5. ***Specific groups or populations use mobile technologies to receive educational content***
   Examples include PSU Móvil, where secondary students use their mobile phones to access practice exercises, diagnostic tests and other key information to help them prepare for the

national university admissions exam; Programa Nacional de Alfabetización, where illiterate youth and adults take a literacy course through mobile devices; and PreveMóvil, where young people receive text messages with health information to prevent the spread of HIV/AIDS. In these types of programmes, a central system sends learning material to the subscribers and tracks their performance and progress.

6. ***University students use mobile technologies to communicate and share information with professors and peers***
   Students and teachers use specialized platforms to communicate, share information, download course material and upload assignments. Examples include BlueGénesis and Blackboard Mobile Learn+, among others. These systems are normally accessed via the internet from any computer and can now be accessed through smartphones, enabling more regular communication between students and teachers.

In the majority of initiatives identified, students use mobile phones independently to access educational content or games. These initiatives typically focus on the development of educational software and digital content rather than teacher training or support. While digital resources form an important component of mobile learning, they are not sufficient on their own; in order to be effective, programmes must also design pedagogical strategies with which to use these resources. Regardless of the technologies used, most learning that occurs in a school context is facilitated by a teacher. The teacher is not just someone who provides resources to students and guides them through a predetermined sequence of activities. Teachers are constantly modifying and tailoring learning activities to meet the needs of their individual students. They use their knowledge of students' backgrounds and interests to motivate their classes; engage in continual assessment, both formal and informal, to determine what their students already know and what knowledge and skills they need to develop; anticipate the types of mistakes and difficulties their students usually encounter and decide how best to address them; use feedback to determine what questions to ask during a lesson to further students' understanding; and evaluate student progress and learning on an individual and class basis. In sum, the teacher is critical to the learning process. The importance of the teacher's role is often overlooked by mobile learning project designers, who may be more concerned with the technology than with student learning.

The three main initiatives identified in this study are exceptions to this trend. The project designers for these initiatives clearly understood the importance of the teacher's role and focused on developing specific methodologies to support teaching and learning in the classroom. The two BridgeIT projects in particular have put teachers at the centre of their programmes. The projects provide teachers with training and support in developing lessons guided by explicit pedagogical principles, with the close supervision of their trainers during the workshops. However, while these workshops may help develop local teachers' capacity for lesson planning, they cannot control how teachers use the lessons in the classroom. As the external evaluation of Chile's Puentes Educativos programme showed, the training provided was not effective in changing teachers' practices. Teachers used the lesson plans and videos but continued to teach in the same way, making little effort to increase student interaction and participation using the methods suggested during the workshop. In contrast, the EMIA-SMILE project relies on the programme's software to facilitate a change in teaching practices. The inquiry-based methodology is embedded in the software, so that when students use the SMILE platform they can only perform the sequence of tasks that have been programed in advance. In other words, the software guides students step-by-step through the learning process. This

allows the teacher to focus on helping individual students and facilitating follow-up discussions that build on the activity. However, apart from training teachers in how to use the software, the project does not seem to have developed a specific programme for supporting teachers as they explore inquiry-based learning, which may be a new concept for many of the teachers who participate. The project might be more effective if it placed more emphasis on training teachers in specific principles and strategies rather than simply relying on the software to transform pedagogy.

BARRIERS TO MOBILE LEARNING

A review of the identified mobile learning projects and relevant literature revealed two key barriers to the development of mobile learning in Latin America: high costs and technology limitations.

HIGH COSTS

The following cost-related issues can impact the sustainability and growth of mobile learning initiatives:

- **Connectivity costs:** When projects rely on mobile phone networks to access the internet, the connection fees are very expensive and difficult to sustain on a large scale. Interestingly, the most relevant projects identified have strategies in place to minimize these costs. For the Puentes Educativos and Raíces de Aprendizaje Móvil projects, connectivity costs are very low because only teachers use mobile phones. In the EMIA-SMILE project, the smartphones used to support in-class activities do not require a mobile broadband subscription; wireless communication between the students' smartphones and the teacher's laptop occurs through a local network using a router provided by the programme.

- **Costs versus services:** Standard mobile phones with basic features, such as text messaging, are inexpensive and widely available, and some mobile learning initiatives may opt to use these phones to reduce costs. This choice represents a trade-off, however, as the educational possibilities are significantly limited in comparison with smartphones. Smartphones offer a wide range of options for use with educational applications and multimedia content, but they are still very expensive and therefore uncommon among students in Latin America, particularly in low-income populations. The three major projects analysed in this paper use smartphones to give students and teachers access to multimedia resources and software, but consequently the programmes must finance the purchase of the devices. While the cost of smartphones is dropping, it is still too high for smartphones to be considered for any nationwide mobile learning policies in the region.

TECHNOLOGY LIMITATIONS

The following technological challenges can interfere with the integration of mobile phones into teaching and learning activities:

- **Speed:** Even very modern mobile phones have relatively slow central processing units (CPUs), which can be frustrating when users are searching for information on the internet. Connecting to the internet through wireless broadband rather than a mobile network can

help mitigate this problem, but internet browsing and downloading is still likely to be slower on smartphones than on laptops, which generally have much more powerful processors.

- **Size:** One of the key benefits to mobile phones is their portability: their small size makes it possible to access learning opportunities virtually anywhere, at any time. However, this same attribute means that the display screens are very small, which limits the possibilities of reading and watching certain types of contents. The two BridgeIT projects resolve this issue by having teachers connect their smartphone to a digital projector to screen videos for the whole class. However, this kind of solution requires extra equipment and restricts mobile learning to a particular time and place (i.e. the classroom).

- **Access to online services:** Initiatives where students produce and publish multimedia content with their mobile phones, such as the Celumetraje project, typically require students to have access to a host website like YouTube, Flickr, Facebook or Wiffiti in order to share their final product with the class. Normally these services are free, accessible and easy to use. However, access to some of these sites may be restricted by school networks or by parents at home. Students and teachers may also encounter technical problems when using these sites that cannot be solved without specialized technical support.

RECOMMENDATIONS

Finally, a careful analysis of the three main projects highlights some of the key success factors for mobile learning initiatives. To develop initiatives that are both scalable and sustainable, policy-makers and education leaders should consider the following recommendations:

1. ***Build alliances with local, national and international partners***
   Programmes should form partnerships with a broad range of organizations, from local NGOs to governments and multinational corporations, to provide the necessary financial, material and human support to schools and teachers. This seems to be the most important factor in enabling projects to scale up from the exploration or research phase. In each of the three major projects described in this paper, strategic partnerships in the country were established from the outset. The key players in these alliances seem to be Ministries of Education, mobile phone companies and educational organizations that support the adaptation of content to local curriculum and teacher development strategies.

2. ***Consider strategies to reduce costs***
   In order to expand, programmes will need to have a strategy in place to minimize costs, especially recurrent ones such as mobile subscriptions. The three major projects reviewed here were all designed with cost considerations in mind. The two BridgeIT projects only provided smartphones and accompanying data plans to teachers, which is significantly less expensive than providing each student with a mobile phone. The EMIA-SMILE programme provided one smartphone for every three students in a class, encouraging collaborative learning while reducing initial and ongoing expenses at the same time. This project also eliminated the need for mobile broadband subscriptions – an added expense – by supplying schools with wireless routers and establishing a local network that enables communication between students' smartphones and the teacher's laptop.

3. ***Develop a comprehensive implementation plan***
   Programmes should design a comprehensive plan for implementation that includes: (a) technical support and anticipation of technological issues; (b) access to educational resources, content and software; (c) alignment with local curricula and educational goals; and (d) teacher support and professional development. These recommendations are applicable to all ICT in education initiatives, not just mobile learning projects. However, because the use of mobile technologies in education is a relatively new phenomenon, these considerations are especially relevant to the success and growth of mobile learning initiatives.

4. ***Prioritize professional development and teacher support***
   To facilitate the successful implementation and expansion of any mobile learning project, it is essential to have a strategy in place for effective teacher training and support. As the BridgeIT and EMIA-SMILE initiatives show, teaching practices have to be carefully guided and supported in order to ensure that teachers are leveraging new technologies to their maximum potential to enhance student learning.

CONCLUSION

While mobile learning brings new promise to education, further research and exploration is needed to generate a fuller understanding of how mobile technologies can improve teaching and learning. This paper aims to contribute to this research by identifying, describing and analysing the most important mobile learning initiatives related to teacher support and development in Latin America. The paper reviewed three major, large-scale projects – two BridgeIT projects in Chile and Colombia and the EMIA-SMILE project in Argentina – which focus on supporting classroom teaching using mobile phones. The paper also briefly reviewed eighteen additional projects, which were included to illustrate the variety and scope of the region's initiatives in the emerging field of mobile learning. Among these initiatives, five focused on school- or classroom-based teaching but were not included in the main review because they had limited coverage or duration, or used a mobile technology other than a mobile phone. The remaining thirteen projects used mobile phones to create informal learning opportunities outside of the school environment. The target populations for these projects included young people and adults, from primary-school students to health care professionals. None of these thirteen projects were focused on providing support or training for teachers.

The three major projects identified aim to provide a well-structured teaching methodology to support the transformation of teaching practices, a powerful approach that builds on lessons gleaned from previous ICT initiatives in the region. In the BridgeIT projects, programme trainers support teachers in planning interactive, student-centred lessons using the project's educational resources, whereas in the EMIA-SMILE initiative, the inquiry-based methodology is embedded in the technological platform itself. All three projects, however, have encountered difficulties that need to be addressed in order to maintain their educational value when scaling up. The BridgeIT projects should design a more structured support system to guide teachers through the implementation process, while the EMIA-SMILE project should consider training teachers on how to follow up with assignments, lessons and discussions that help students get the most out of the inquiry-based activities.

In order to achieve long-term sustainability and growth, all three projects may also need to reconsider their choice of mobile technology. Because of their private-sector origins, these projects all use smartphones to deliver educational content. Although the BridgeIT projects have built strong alliances with the Ministries of Education in Chile and Colombia to support their expansion, they may have difficulty gaining national funding for the purchase of smartphones, which does not necessarily make sense in schools with existing ICT infrastructure. The EMIA-SMILE project is in a similar situation. Mobile learning programmes based on smartphones pose a financial barrier for Latin American governments that are still in the process of fulfilling commitments to provide computer labs for schools and laptops or netbooks for students.

In general, cost is a key factor to consider when analysing the feasibility of mobile learning projects in Latin America. Devices with multimedia capabilities like smartphones are still expensive in the region, as is internet access via mobile broadband. Attention should also be given to issues related to connection and processing speed, display size and additional web

services required to implement the programme. Finally, in order to sustain and expand mobile learning projects, it is essential to build partnerships with local organizations and to carefully design a comprehensive strategy for implementation that includes technology and technical support, digital content and software, methodology and pedagogy, local and national curricula, and teacher support and development.

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APPENDICES

APPENDIX A: Mobile learning project documents and websites

The following documents and websites were consulted for this review. Some were obtained through contact with project managers and others were found through internet searches.

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- Educación Móvil Continua en la Salud (Peru): http://www.zoltner.com/proyectos/
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APPENDIX B: Mobile learning project information

PUENTES EDUCATIVOS, CHILE

The Puentes Educativos initiative is part of the BridgeIT global network, a multisector association of interactive multimedia education programmes for local classrooms around the world. The network includes Nokia, the International Youth Foundation (IYF), Pearson and the United Nations Development Programme (UNDP). The first BridgeIT project was implemented in the Philippines in 2003.

Puentes Educativos is the first BridgeIT project in Latin America. The organization responsible for implementation is the Asociación Chilena pro Naciones Unidas (Chilean Association for the United Nations, ACHNU), a non-profit organization for social development. Aside from this organization, the project is also supported by Telefónica Movistar, the Asociación Chilena de Municipalidades (Chilean Association of Municipalities, ACHM) and the national Ministry of Education. The Chilean BridgeIT initiative developed out of a previous partnership between Nokia and ACHNU for the Entra 21 project, which sought to enhance labour market inclusion of vulnerable youth. The success of this project encouraged ACHNU and Nokia to continue working together to implement Puentes Educativos.

The general objective of the initiative is to improve the learning of students in Grades 5 and 6 in municipal and underserved schools in Chile, through the use of mobile technologies and digital education resources for mathematics, science and English. The specific objectives are to: (a) improve teaching practices and teacher-student interaction by promoting and developing a participatory learning environment in the classroom; (b) encourage the use of ICT in the classroom, specifically mobile technology; (c) develop teachers' competence in using ICT for teaching; (d) introduce digital education resources as an effective supplement and support for classroom teaching; and (e) improve teacher and student motivation in teaching and learning.

The teachers involved in the project receive a Nokia smartphone with a plan for unlimited internet access (without phone call services) provided by Movistar. Teachers use the smartphone to download and store educational materials and to show educational videos to the class with a data projector. The smartphones are equipped with a Nokia application called Nokia Education Delivery (NED), which provides access to an extensive library of educational videos on science, mathematics and English developed by Pearson. The videos are high-quality short movies (three to five minutes) that are designed to introduce and illustrate a topic as well as motivate and engage students. The videos typically depict an explanation, experiment, animation or recreation related to a specific lesson or concept. Teachers select the videos to be used for the project from the Pearson library according to local curriculum needs.

Overall, the project claims that its focus is not on technology but on teaching. It provides teachers with lesson plans that cover two years in each subject (math, science and English). The lesson plans are designed following three main pedagogical principles: (a) participatory learning; (b) student collaboration; and (c) student-centred classrooms based on dialogue and

discussion. Considering these principles, the initiative developed a methodology based on the following components:

- Initial motivation: students activate their prior knowledge about the subject.
- Use of sources: students integrate their previous knowledge with new content provided by the videos and also search for information on the internet.
- Learning by doing: students apply their new knowledge through practical activities such as debates and group projects.
- Feedback: teachers support student learning by answering questions and tracking and evaluating student progress.
- Applied knowledge: students apply their new knowledge to everyday life and reflect on ways to use this knowledge in the future.

The lesson plans were designed by the teachers involved in the project's training process during two workshops in early 2010 and 2011. In these workshops, the teachers received all of the videos produced by Pearson, reviewed and discussed them in groups, and chose which videos to include in the lesson plans. By the end of each workshop, the teachers had created a complete file of lesson plans for each grade level and subject. Afterwards, experts from the programme and the Ministry of Education reviewed and adjusted the lesson plans. In 2012, the new teachers starting the programme will receive a set of lesson plans that they can customize according to their own school and classroom contexts. This set of lesson plans covers two years (Grades 5 and 6) and incorporate one video per week.

Puentes Educativos also claims to promote a participatory learning environment, in which the teacher facilitates student interaction with the subject matter, while students carry out practical activities in the classroom in groups or pairs. This approach aims to transform the traditional pedagogical model of the teacher as the person who directs and controls the learning process into a model in which the student is the principal actor in his or her own learning.

The project has a structured teacher support and training strategy that aims to develop teachers' technological and pedagogical capacities. At the beginning of the first year, teachers participate in an eight-day workshop to learn how to manage the video library through the mobile phone and to design or customize the lesson plans they will use during the next two years. In the middle of each year, teachers also attend a one-day workshop to reinforce pedagogical strategies and help resolve any issues that teachers may be facing in their classes. In addition, twice a year a trainer from the project visits each teacher at the school to provide more personalized support. To further support the teachers involved in the project, Puentes Educativos also works with school administrators and principals. The programme communicates regularly with these administrators and gives them feedback on teachers' work.

So far the project works with 200 schools, 600 teachers, and 22,000 students in vulnerable schools in Chile. Initially, Puentes Educativos was designed to last three years. Currently the projects' administrators are looking for new partners to allow the project to continue. One

possibility is that Puentes Educativos may become a national programme through the support of the Ministry of Education.

During 2011, Universidad Alberto Hurtado (Alberto Hurtado University) in Santiago, Chile conducted an evaluative case study of the project, which revealed several implementation challenges. On the one hand, the study confirmed the value of the project for teachers and principals. On the other hand, the evaluation found that the project did not change teaching practices as much as it intended. Even when 75% of the teachers stated that they used the project's lesson plans and 65% claimed that they used the videos, in practice only a few teachers actually used a more interactive pedagogical approach. In addition, some teachers reported technical issues, while others expressed dissatisfaction with the workshops. The project's team is now reviewing this feedback to improve teacher support strategies for 2012.

RAÍCES DE APRENDIZAJE MÓVIL, COLOMBIA

Raíces de Aprendizaje Móvil is the Colombian version of Puentes Educativos. Both programmes are part of the BridgeIT global network and include alliances with local partners like Telefónica Movistar to provide internet access. However, Raíces de Aprendizaje Móvil has some unique features not shared by the Chilean project. First, the project involves the active participation of the Colombian Ministry of Education and is part of the national education policy. Second, this project emphasizes teacher support to a greater extent than Puentes Educativos. The programme plans to create an accompanying project, called the Coaching Community**,** which will be a digital platform that teachers can access to share experiences, concerns and solutions to problems. At present the Coaching Community operates as an online forum where teachers can ask questions and help each other solve problems, but in the future it also will allow them to access and share information via text messaging.

The Colombian programme's main objective is to raise the quality of education through the use of digital content, teacher training and the inclusion of mobile devices in student learning. The project's specific objectives are: (a) to encourage the pedagogical use of digital education content as an effective complement and support for the teaching-learning process; (b) to implement pedagogical strategies aimed at developing participatory learning environments; (c) to raise teacher and student motivation in the teaching-learning process; (d) to create alternative access to online education content through mobile phones; and (e) to develop teachers' ICT skills through participation in the project's Coaching Community.

The Raíces de Aprendizaje Móvil project is focused on students in Grades 4 and 5 in low-income elementary schools, in areas with high social vulnerability and little access to new technologies. The initial implementation plan covers seventy-five schools in three different areas of Colombia (the jungle, the central area near Bogotá, and the coast). The initial target subjects are social science and mathematics. The programme will be implemented as a pilot project for a three-year period.

ENTORNO DE MÓVIL INTERACTIVO DE APRENDIZAJE (EMIA-SMILE), ARGENTINA

The EMIA-SMILE programme currently implemented in Argentina is an adaptation of the Stanford Mobile Inquiry-based Learning Environment (SMILE) project led by professor Paul Kim of Stanford University in the United States, as part of his work on the Programmable Open Mobile Internet (POMI) project. POMI was designed to develop and assess wireless mobile technology and interactive systems for informal and formal learning. Stanford University's Seeds of Empowerment programme is responsible for seeking local partners to implement SMILE projects in other countries.

In Argentina, the project began in August 2011 in a rural primary school in the province of Misiones. This pilot experience is aimed at testing the project's software platform, training strategies and mobile devices as well as gauging teacher and student perceptions of the programme. The pilot project will last eighteen months and plans to reach twenty schools.

The SMILE programme is the latest research project by Kim, who previously developed the PocketSchool initiative, a programme for children in underdeveloped countries with no access to formal schooling. The programme provided children with a Stanford-designed mobile device (similar to Nintendo's Game Boy) for accessing e-books and educational games. PocketSchool began in several countries in Africa and India in 2007, and pilot projects have been implemented in Latin America since 2009, in countries like Mexico, Costa Rica, El Salvador, the Dominican Republic and Argentina.

The SMILE platform, which uses smartphones and a mobile application, was launched in October 2010. The objective of the project is to encourage critical thinking, creativity, reading and writing skills, and scientific attitudes in students. To reach these goals, the SMILE platform supports an inquiry-based learning activity in which students create and assess their knowledge in a specific school subject by asking questions and doing research activities. The first SMILE pilot programmes were launched in India and Malaysia in February 2011. Since implementing the project in Argentina, Seeds for Empowerment has initiated talks with public and private institutions in other Latin American countries to find new partnerships to extend the project in the region.

The project's main technology components are smartphones for the students (without any communication services) and a laptop for the teacher. These components are connected to a local Wi-Fi network (the project provides a router for the classroom). The phones used in the Argentine pilot project are Motorola Droids with touch interfaces and QWERTY keyboards, but the programme is not exclusively designed for any specific brand of mobile phones.

In the classroom, students divide into groups of three with one smartphone per group, while the teacher follows classroom activities using a laptop computer. Each group has to create a question about the lesson topic that the other groups have to answer. Once the questions are answered, students assign a score to each question to rank them and identify the best. More specifically, the SMILE teaching methodology is based on the following steps:

1. The teacher or facilitator introduces the content and students are assigned to groups of three.

2. The groups are asked to review what they have just learned and to discuss the subject in order to create a multiple-choice question for the rest of the class.

3. Each question must be complemented with some kind of multimedia enhancement recorded with the smartphone (e.g. a photograph of a textbook illustration or object in or outside the classroom, or a short video dramatization).

4. Each group enters their multiple-choice question on their smartphone and then posts it to the SMILE platform, so that other groups can access it.

5. Each group answers and evaluates the other groups' questions (e.g. if there were twenty-seven students – nine groups of three – each group would have to answer eight questions)

6. The teacher reads the questions aloud and discusses the answers with the students. Finally, the teacher announces which group answered the most questions correctly and which group created the best question, according to class rankings and teacher review.

SMILE claims that the project has developed a strategy that maximizes efficacy in student learning. First, the project encourages collaborative and critical thinking by asking students to create multimedia multiple-choice questions in groups. Second, it promotes reflection and critical thinking through peer assessment. Third, the programme increases student motivation through a healthy, low-pressure competitive learning environment. Finally, it generates valuable information for formative assessment by allowing teachers to easily access, analyse and store the sets of questions and answers that students create.

To help teachers apply the SMILE method and technology, the project offers a two-to-three-day initial workshop. In addition, the project provides continuous support through weekly meetings and online forums.

During the pilot project, two other smartphone applications developed by Stanford were tested: e-Book Maker and the Remotely Operated Science Experiment (ROSE). e-Book Maker allows students to create stories based on their local culture and post them to a special website on the internet. ROSE allows students to manipulate sensors and experimental conditions in remote Stanford labs though a smartphone as part of guided activity in science.

The SMILE project's model for sustainability is based on a partnership between three key players: (1) a strategic partner, chiefly responsible for funding (this could include a government ministry or department, or a private enterprise); (2) an academic partner, such as a university; and (3) a local partner, such as an NGO, a foundation or a community centre. In the case of Argentina, the Telecom enterprise is supporting the project as part of their Corporate Social Responsibility programme. In addition, the Ministries of Education in two provinces, Misiones and Buenos Aires, gave their approval and will be observing the project.

CELUMETRAJE, ARGENTINA

This initiative was carried out in 2009 by one teacher, Sergio Bosio, in two classes (Grades 4 and 5) in Escuela Normal Number 38, in Villa Cañas, Santa Fe, Argentina. The initiative involved students in the creation of three-minute videos that were recorded on mobile phones and later edited and published to the internet using desktop computers.

First, students had to design a storyboard or a graphic script, consisting of a series of images shown in sequence, by using the Microsoft program called 'Digital Storytelling in the Classroom'. Then, students had to record the planned scenes with their mobile phones. In the post-production stage, students used computers in school labs to edit the videos and produce the short film. Standard and open-source software were used for this purpose. Finally, the videos were copied to a DVD to be shown to the class and uploaded to YouTube.

The main goal of this activity was to teach students to use new technology and software. The activity organized the students into groups that worked in the following sequence: (a) brainstorm ideas for the video; (b) design the storyboard; (c) assign roles for each student in the group; (d) record the video with a mobile phone; (e) transfer the video from the mobile phone to a desktop computer; (f) edit and finalize the video; (g) copy the video onto a DVD; (h) show the video in class; and (i) publish the results on the internet.

EDUMÓVIL, MEXICO

Edumóvil is an academic programme that was launched in 2003 by the Electronics and Computer Institute of the Universidad Tecnológica de Mixteca in Mexico. The programme develops educational applications to improve learning for primary-school students by integrating mobile technologies into the classroom. Since 2007 the Motorola Foundation has supported the programme with the aim of including mobile phones in the programme's developments. Before the Motorola Foundation joined in, the programme followed the trajectory of the Chilean research programme Eduinnova, aiming to support a collaborative learning process by developing mobile applications on hand-held personal digital assistant (PDA) devices. Since the strategic alliance with Motorola, the project was able to include mobile phones in addition to PDAs, and currently all Edumóvil applications have been migrated to Motorola phones.

Edumóvil has developed applications for four primary-school subjects: Spanish language, mathematics, history and natural sciences. In mathematics, Edumóvil developed a game for PDAs that provides an easy and fun way to develop children's problem-solving and information-processing skills. In Spanish language, the project created an animated reading library accessible through PDAs to develop student's communication skills in written and spoken Spanish. In history, Edumóvil developed a collaborative application aimed to support group timeline-building. Timelines are typically used at the end of a study period for children to identify stages and periods of history. This application allows each group of students to timeline fragments in a sequence and send their results to the server for whole-class discussion and assessment. Lastly, in natural sciences the project developed a collaborative 'predator-prey' game as an auxiliary tool for students to learn about behaviour and population growth in the ecosystem.

VIDHAC2, CHILE

The Videojuegos para el Desarrollo de Habilidades en Ciencia a través de Celulares (Video Games for Developing Science Skills through Mobile Phones, ViDHaC2) project was an initiative of professor Jaime Sanchez of the Computer Science Department in the School of Physics and Mathematical Sciences at the Universidad de Chile. The project aimed to produce role-playing video games for mobile phones that developed and exercised problem-solving skills, improved science learning among students and strengthened teaching. The project also produced a video game editing program for mobile phones that allowed teachers to easily and quickly design science-based video games for students.

The project was implemented over a period of three months in five different schools. Teachers from these schools carried out two teaching activities each. The video game activities were conducted in a variety of locations, including an educational centre, a supermarket, a science museum and a zoo. In the activities conducted on school grounds, teachers made creative use of school areas such as the schoolyard and the science laboratory, and in some cases included technology resources available at the school.

EDUINNOVA, CHILE

Eduinnova is a long-term research and development programme at the Pontificia Universidad Católica de Chile led by professor Miguel Nussbaum. Eduinnova has developed models for the inclusion of mobile technology in the classroom aimed at improving primary and secondary subject-learning and promoting the development of communication and social skills.

Eduinnova began in the late 1990s, initially developing math games for independent learning using a Game Boy-style device. In the early 2000s Eduinnova developed a hand-held/PDA-based model to support collaborative activities in the classroom, in which students used a mobile device in groups of three to answer a multiple-choice questionnaire designed by the teacher with the support of Eduinnova. To promote interaction and collaboration, students had to agree on their answers with the other members of their group. Meanwhile the teacher followed the activity and monitored the groups' progress on his or her own mobile device. In the late 2000s this model was transferred to MS Windows netbooks in order to lower costs for scaling up. Eduinnova has developed a well-structured scaling-up strategy, which includes a teacher development plan and technological support, among other things. The Eduinnova model is currently being used in approximately 100 schools in Chile and it has been tested in schools in Argentina, Brazil, the United States and England.

POCKETSCHOOL, EL SALVADOR

This project is part of a global initiative led by professor Paul Kim at Stanford University in the United States. In El Salvador, the project is led by Universidad Tecnológica. The PocketSchool global initiative is aimed at children in underdeveloped countries, especially those living in rural areas who do not have regular access to schools. It provides children with a Stanford-designed mobile device called TeacherMate (similar to a Game Boy device) for accessing e-books and educational games for independent learning. The initiative began in several countries in Africa and India in 2007, and since 2009 several pilot projects have been implemented in Latin American countries, including Mexico, Costa Rica, El Salvador, the Dominican Republic and Argentina.

PSU MÓVIL, CHILE

This project began in 2008 and is led by Educarchile, the state-funded national portal for education in Chile. Its purpose is to provide test-like exercises through mobile phones to help students prepare for the Prueba de Selección Universitaria (University Selection Test, PSU), the national university entrance exam. It also provides relevant information like dates and deadlines for the test. Students can subscribe to the service for free on the Educarchile website, download the PSU application to their mobile phones from a Wireless Application Protocol (WAP) server, and receive information and practice test results via email. The application is compatible with Sony Ericsson, Nokia, LG and Samsung mobile phones. The application includes modules for test preparation in Spanish language, math, history and science.

EVALUACIÓN DE APRENDIZAJES A TRAVÉS DE CELULARES, PARAGUAY

This initiative was carried out by the Ministry of Education and Culture (MEC) of Paraguay during 2011. It was a pilot project that used mobile phones to assess the quality of student learning: 10,000 students at 300 secondary institutions answered a multiple-choice test on their own mobile phones, and the results were sent via text message to the MEC.

BLUEGÉNESIS, COLOMBIA

This project began in 2008 as a personal initiative of professor Oscar Figueredo as part of his Master's Degree in Systems and Computer Engineering at the Universidad de los Andes. It was later adopted by Móvil Soluciones (Mobile Solutions), a company dedicated to developing academic software for mobile devices.

BlueGénesis is an academic platform that uses mobile phones to support communication and the teaching-learning process at the university level. By using Bluetooth connectivity, teachers can send questions, tests, content and messages to students' mobile phones from their laptops. Students can read materials, answer questions and receive feedback on their mobile phones.

M-ILAB, MEXICO

The Mobile Intelligent Laboratory (M-iLab) initiative was created in 2010 by David Poot Rodriguez, a faculty member of the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) in Mexico. It aims to develop mobile phone applications for teaching physics. An application to illustrate the theory of simple harmonic motion and momentum was created for the Apple iPhone. The device itself becomes part of the experiments: when students apply movements to the phone (hanging it as a pendulum, for instance), the iPhone's motion-detection software registers the movements and the application records the information in XYZ graphs for further analysis. The Apple iTunes Store plans to offer the application for downloading sometime in the near future.

POSTÍTULO DE ESPECIALIZACIÓN SUPERIOR EN EDUCACIÓN A DISTANCIA, ARGENTINA

This initiative is part of a blended-learning graduate course about Distance Education at the Universidad del Salvador in Rosario, Argentina. In the 2001 version of the course, students used a BlackBerry mobile phone to access unit contents, tutorials and chat activities.

APRENDIZAJE MÓVIL PROJECT AT ITESM, MEXICO

This initiative was carried out in 2007 and 2008 to support virtual and face-to-face courses at two campuses of the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) in Mexico. The project sought to develop students' twenty-first century skills by providing access to course content via mobile devices. Students used a BlackBerry mobile phone to access videos, audio files and exams, and to communicate with their teachers and classmates through email.

PROYECTO FACEBOOK, ARGENTINA

This initiative was carried out in 2008 and 2009 by professor Alejandro Piscitelli within the Communication Sciences degree programme at the Universidad de Buenos Aires in Argentina. As part of a wider class project, students used mobile phones to make short videos.

BLACKBOARD MOBILE LEARN+, MEXICO

This initiative started in 2010 at the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) in México. University students access course websites, receive notifications and interact with professors and peers through a Blackboard platform from their iPhones or other Apple devices (iPod, iPad, Macbook, etc.).

KANTOO, VARIOUS COUNTRIES

This is a paid service provided since 2008 by La Mark, a company that develops educational content for mobiles. The service began in Venezuela and later spread to Chile, Peru, Colombia, Mexico and Brazil. It offers English practice through small applications and interactive text messaging via mobile phones. Kantoo provides units that involve writing, reading, grammar and speaking exercises for users to progress from basic to intermediary English.

PROGRAMA NACIONAL DE ALFABETIZACIÓN, COLOMBIA

The Ministry of Education of Colombia has promised to launch this initiative in 2012 as part of its National Literacy Programme. The government will distribute mobile phones and special SIM cards to illiterate youth and adults throughout the country. Users will be able to access talks and interactive contents for six levels of literacy education. The software for each level will be available on a SIM card that the user has to change in order to progress to the next level. The service is aimed at people in underserved populations who did not receive formal schooling.

PREVEMÓVIL, HONDURAS

This project aims to prevent the spread of HIV/AIDS in highly vulnerable youth populations and to reduce high-risk behaviours associated with this pandemic in Honduras. The programme sends information about how to prevent the disease through text messaging and online social networks. The project was launched by the Zoltner Consulting NGO and uses a mobile online information platform developed by DataDyne.org to send and receive messages. The initiative is sponsored by the Government of Norway and the Pan-American Health Organization.

EDUCACIÓN MÓVIL CONTINUA EN LA SALUD, PERU

This project, developed in 2009 and 2010 in Peru, aims to update the knowledge of health workers by sending key professional information to their mobile phones using text messaging. Like the PreveMóvil programme in Honduras, this project was launched by the Zoltner Consulting NGO and uses a mobile online information platform developed by DataDyne.org to send and receive messages. The initiative is sponsored by the Ministry of Health of Peru and the Pan-American Health Organization.

DATAGRO, CHILE

This project aims to take advantage of massive mobile phone penetration to send relevant and useful information via text message to small farmers in Chile's VI Región del Libertador General Bernardo O'Higgins (O'Higgins Region). Information includes market prices, weather reports and farming news, among other things. Like the health education projects in Honduras and Peru, the project was launched by the Zoltner Consulting NGO and uses a mobile online information platform developed by DataDyne.org to send and receive messages. The initiative is sponsored by the Chilean Agrarian and Innovation Foundation (FIA), UNESCO and the Entel PCS telecommunications company.

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

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

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

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

Collectively and individually, the papers in the UNESCO Working Paper Series on Mobile Learning scan the globe to illuminate the ways in which mobile technologies can be used to support Education for All Goals; respond to the challenges of particular educational contexts; supplement and enrich formal schooling; and, in general, make learning more accessible, equitable and flexible for students everywhere.

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