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MOBILE LEARNING FOR TEACHERS IN EUROPE

> 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.

UNESCO has plans to add additional titles to the Series after 2012. The Organization hopes that these resources will help diverse audiences better understand the educational potential of mobile technologies.

To access existing and forthcoming titles in the Series, please see:
http://www.unesco.org/new/en/unesco/themes/icts/m4ed/

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ABSTRACT

This paper reviews and analyses current and recent initiatives involving the use of mobile technologies for teacher support and professional development in Europe. Many of the initiatives are local, small-scale projects, often based in a single school or class. A handful are much larger projects that aim to have a substantial impact on education at a national or regional level. As a whole, the initiatives discussed in this review were selected to demonstrate the wide range of current activity in mobile learning throughout Europe and illustrate strategies that might be applied to future projects.

The focus areas of the initiatives fall roughly into four broad categories: 1) projects that use mobile technologies for teacher training and professional development; 2) projects that use mobile technologies to support teachers in their administrative duties; 3) projects that use mobile learning to support instruction; and 4) projects that provide research and recommendations on mobile learning for educators and policy-makers.

Only three projects focused explicitly on teacher training or professional development. These projects were part of the United Kingdom's MoLeNET initiative, one of the largest and longest-running mobile learning projects in Europe. Two of the MoLeNET projects used mobile technologies to support mentorship, observation, reflection and self-assessment in teacher training programmes, while the third encouraged new teachers to incorporate mobile technologies into their practice and develop innovative lessons and activities based on mobile learning. Unfortunately the MoLeNET programme has now ended and its sub-projects are no longer publicly funded.

The majority of projects identified are aimed at supporting instruction, both in and outside of classrooms. These projects tend to be targeted primarily at students and usually involve mobile technologies that students use semi-independently in a classroom or after-school setting to supplement or enhance teacher-led instruction. While none of these projects are focused on teachers explicitly, many include a teacher-training component to help educators incorporate mobile learning into their curricula and guide students through the learning process.

While evaluative data is not available for all of the projects described, many of the initiatives have conducted project assessments and published their results. Initial project outcomes suggest that mobile learning may be linked to improvements in student achievement, attendance and retention at the primary, secondary and tertiary education levels. In addition to describing the results of individual projects, this paper also compares and analyses the identified mobile learning initiatives in terms of their objectives and target populations.

Some large-scale projects are aimed primarily at facilitating research and collaboration in the field of mobile learning. These types of projects are generally funded by a national government or the European Union. Additional projects focus on improving administration and communication within an institution through the use of mobile technologies. Within this category, university-based projects often aim to increase interaction between students and teachers and to improve students' access to information related to their academic and

personal needs. Projects at the primary- and secondary-school levels tend to be more geared toward facilitating communication between teachers and parents, and providing parents with information about school events and schedules. The vast majority of projects are targeted at pedagogy. While the specific goals of these projects vary widely, all aim to enhance instruction, support student learning, and improve pedagogical practices through the use of mobile technologies. Some projects support existing curricula, while others provide new types of learning opportunities that move beyond core subjects and traditional teaching models. Many of these projects encourage learning that is more collaborative, interactive, experiential and student-centred.

In terms of target population, the majority of projects identified focus on older learners, including university students, vocational trainees and apprentices, and professionals engaged in continuing education or lifelong learning. Potential reasons for the prevalence of mobile learning initiatives at this educational level include the high penetration rate of mobile devices among young people and adults, fewer concerns about behavioural issues and student safety related to mobile phone use, and a large population of students who need flexible learning options that fit into their work schedules.

This paper also identifies key factors influencing mobile learning in Europe. The primary drivers for mobile learning include government and EU support for lifelong leaning, the need for improved communication at universities and school, and EU and national objectives for increasing student achievement and lowering drop-out rates. The main enablers for mobile learning are widespread mobile phone ownership and familiarity with mobile devices. Key success factors include the availability of public funding, and national or regional leadership and guidance in implementing mobile learning projects. There are also several barriers to mobile learning which may need to be overcome before mobile technologies can be incorporated into mainstream education. The main barriers are the high costs associated with purchasing mobile devices and data plans, and negative social attitudes about the use of mobile phones in schools. To overcome the first impediment, institutions may try to reduce expenses associated with mobile learning by encouraging students to bring their own devices to school; however, this approach introduces equity issues that will need to be addressed directly before such a project can be considered feasible. The second barrier may prove difficult to overcome, as public perceptions about the disruptive nature of mobile phones seem to be widespread in Europe. To challenge these views, information and research about the benefits of mobile learning and specific project outcomes should be disseminated widely among key education stakeholders, including teachers, administrators, parents, policy-makers and students.

BACKGROUND

Europe comprises approximately fifty countries, twenty-seven of which are members of the European Union. Mobile phone use in Europe is extremely high, with approximately 120 mobile phones for every 100 people (mobiThinking, 2011). In the United Kingdom, recent research indicated a 67% increase in the amount of data transferred via mobile networks in 2010, and by the first quarter of 2011 half of all new mobile phones sold in the UK were smartphones (Ofcom, 2011). As prices for devices and data usage drop, other countries in Europe are experiencing similar increases in smartphone penetration and mobile data usage.

The proliferation of mobile devices in Europe represents an opportunity to explore the potential of mobile learning – learning facilitated by mobile technologies – to enhance education. Mobile technologies can be used to increase students' access to education, support teachers' professional development, and strengthen teaching and learning both in and outside traditional school settings. European governments and organizations have funded a number of mobile learning initiatives, yet very few of these projects have examined the educational use of mobile phones specifically, tending to focus instead on larger mobile devices like laptops, netbooks, game consoles and tablet devices. This represents a missed opportunity for educators and policy-makers, as mobile phones – especially smartphones – can be equally powerful learning tools that are significantly less expensive than other devices like laptops and tablets. Also, given the ubiquity of mobile phones in Europe, it is likely that most teachers and students already own a standard mobile phone or smartphone, which may significantly reduce costs associated with equipment and training when implementing mobile learning programmes in schools.

This paper identifies and describes the major mobile learning initiatives that use mobile phones to support teachers and improve teaching practices in Europe. In the context of this review, 'mobile learning' is restricted to the use of mobile phones, either alone or in combination with other technologies, for teacher support and development. Also, for the purposes of this paper, 'teacher' refers to any adult who has teaching responsibilities, irrespective of formal qualifications or employment status.

METHODOLOGY

Data for this paper were collected between September 2011 and January 2012, primarily through email communication and interviews with experts in the fields of education and technology, as well as through internet searches.

In late 2011, a separate policy review of mobile learning in Europe was conducted on behalf of UNESCO. As part of that policy review, an email questionnaire seeking information on mobile learning policies was distributed to thirty Ministries of Education within Europe. This paper was originally intended to draw heavily on questionnaire responses to identify relevant mobile learning projects for teacher support and development in Europe. However, to date only two countries – France and the Netherlands – have provided responses to the questionnaire. The minimal response to the questionnaire may indicate that mobile learning is not prioritized at the policy level in most European countries; however, it may also be due, at least in part, to the impersonal nature of the survey request, which in most cases was sent to a generic Ministry of Education email address rather than an individual.

To compensate for the paucity of questionnaire responses, researchers identified and directly contacted education and technology experts in fifteen European countries. For a list of the countries surveyed, see Appendix A. Experts received an email, reproduced in Appendix B, that included a short series of questions about mobile learning projects. This more personal approach resulted in a much higher response rate, with experts from eleven countries providing responses. Subsequent phone and face-to-face interviews were also carried out with some experts. These interviews were used to supplement the more structured information from questionnaire and email responses. Information regarding mobile learning was also gathered through internet research.

MOBILE LEARNING INITIATIVES

Research for this paper identified sixteen recent or ongoing mobile learning initiatives related to teacher support. All of the projects described are either still underway or were completed in or after 2009. The majority are focused on tertiary education at universities, colleges and vocational schools and training centres. The initiatives fall roughly into four categories:

1. Projects that use mobile technologies in teacher training and professional development
2. Projects that use mobile technologies to support teachers in their administrative tasks
3. Projects that use mobile learning to support instruction in and outside of school
4. Projects that provide educators and policy-makers with research and recommendations on best practices for mobile learning

Table 1. Mobile learning initiatives for teacher support and professional development

Focus area	Initiative / Institution	Countries
Teacher training and professional development	MoLeNET	UK
Administrative support	UnivMobile	France
	Mobilskole	Norway
	Yorkshire Coast College	UK
	Mobile Oxford	UK
Instructional support	Mobile in Salford	UK
	Presemo	Finland
	WapEduc	France
	University of Leeds Medical School	UK
	Distance Learning for Apprentices	Denmark, Germany, Portugal, Spain, Turkey
	Priory School	UK
	Apps for Good	UK
	BlackBerry Academic Program	Multiple countries
	REACH	Italy, Norway, Spain, Turkey
	ENVI GAME	Czech Republic
Research	MOTILL	Hungary, Ireland, Italy, UK

TEACHER TRAINING AND PROFESSIONAL DEVELOPMENT

The most relevant mobile learning projects for teachers focus on professional development and teacher training. The Mobile Learning Network (MoLeNET) programme in the UK, which comprised a vast assortment of mobile learning projects, included three projects that aimed to increase teachers' access to mentors and supervisors, facilitate self-assessment and reflection on teaching practice, and encourage innovative thinking about the use of mobile technologies to support student learning.

MOLENET (UK)

The MoLeNET programme was one of the largest mobile learning initiatives in Europe. Launched in 2007, the programme aimed to encourage the use of hand-held technologies to enhance and extend the reach of teaching and learning. Capital funding was provided by the UK government through the Learning and Skills Council (LSC), a non-departmental public body that was replaced by the Skills Funding Agency and the Young People's Learning Agency in 2010. Matching funds were provided by many schools and colleges throughout the UK. The Learning and Skills Network (LSN), a non-profit organization dedicated to education technology, research, and training services, provided participating institutions with a support programme for teachers and administrators that included professional development, advice and guidance, mentoring and peer-to-peer support, resource and knowledge sharing, and networks for collaboration (Douch et al., 2010).

The MoLeNET initiative provided 16.5 million British pounds to 104 separate mobile learning projects at 147 colleges and universities and 37 primary and secondary schools throughout the UK. The projects engaged approximately 40,000 individual learners and over 7,000 teachers and administrators. Most projects targeted students between the ages of 14 and 19, but many projects also aimed to support older students undergoing vocational training in a wide range of subject areas, from animal care to art and design. MoLeNET projects explored the educational uses of mobile phones, personal digital assistants (PDAs), hand-held gaming devices and MP3 players, often in conjunction with virtual learning environments (VLEs) and 3G (third-generation) and broadband networks. MoLeNET enabled participating institutions to share resources and learn from each other's experiences.

Three MoLeNET projects were specifically aimed at using mobile technologies to support professional development and training for teachers (Douch et al., 2010). The project at Accrington and Rossendale College, called Promoting Retention and Achievement in Teacher Training Using Mobile Devices, used Skype in conjunction with mobile phones to enable teachers-in-training to communicate with their supervisors and mentors remotely from school sites. Cornwall College's Supervision of Trainee Teachers project provided in-service and pre-service teachers with video cameras to record their teaching for self-assessment and reflection. At St Helens College, the Encouraging Trainee Teacher Innovation project supplied pre-service teachers with a range of mobile devices and asked them to consider how they would use them in their teaching practice and to predict the impact the devices would have on their planning, delivery and assessment. The mobile equipment provided by this project included hand-held video cameras, helmet cameras and digital voice recorders.

The LSN collected data and information on the outcomes of individual MoLeNET projects. A 2010 report summarized key findings from these three teacher-targeted projects (Douch et al., 2010). The findings indicated that mobile technologies can improve professional development and teacher training in several areas:

- **Communication:** Mobile devices can be used in conjunction with wireless broadband and video-call services like Skype to facilitate communication between teachers and mentors.

- **Self-assessment:** Video cameras can be used to record lessons, allowing teachers to reflect on their teaching practice and identify specific areas for improvement.

- **Innovation:** Mobile technologies can be used in teacher education programmes to challenge teachers to think creatively about mobile learning and develop the confidence to try new ideas.

The LSN also conducted an overall assessment of the impact of the MoLeNET programme. This evaluation suggested that the use of mobile technologies in education has a positive impact on learner retention and achievement. Participating institutions reported an average improvement in learner retention of 8% in the first year of the programme, followed by a 7.8% improvement in the second year. Institutions also reported that student achievement improved by nearly 9.7% in the first year of the programme and 13.4% in the second year. While these statistics do not necessarily reflect a direct correlation between mobile technology and learning improvements, they do suggest a positive impact associated with the MoLeNET initiative in general.

When MoLeNET came to a close in 2010, attempts were made to sustain some of the programme's beneficial work. First, individual colleges were encouraged to continue developing mobile learning projects. While focused funding was no longer available, the LSC initially continued to provide support services to institutions, organizations and practitioners. Encouragingly, of the sixty institutions surveyed at that time, 80% reported that they planned to invest their own money in further mobile learning projects. In addition, the programme designated eight schools and colleges as 'MoLeNET academies'. These academies were challenged to become centres of excellence for mobile learning and to champion the use of mobile technologies in teaching, learning and assessment. The academies were encouraged to support professional development on the topic of mobile learning and to provide training facilities to develop the mobile learning skills of teachers and administrators in their local areas.

ADMINISTRATIVE SUPPORT

Mobile technologies are also used to support to teachers in administrative tasks like posting grades, disseminating information about class schedules and exam dates, and, in primary and secondary education, communicating with parents about school events, field trips and student attendance and behaviour. Ongoing projects in France, Norway and the UK focus on using mobile applications and basic services like text messaging to facilitate schools' and teachers'

communication with students and parents and allow teachers to send information quickly and easily via mobile devices.

UNIVMOBILE (FRANCE)

UnivMobile is a university-based project that uses mobile technology to assist communication between teachers, administrators and students in France. The project is implemented on a large scale: the first phase targeted 87,000 students, and there are plans to extend the project's reach to all of the 380,000 students in the Île-de-France region in 2012.

UnivMobile's main objectives are to provide mobile applications for smartphones that assist students in navigating university life. Key modules provided by UnivMobile include Mon-Ent, which allows users to contact professors, look up course schedules, confirm exam dates, view test results, and receive messages from professors and administrators; and Geo-Campus, which provides interactive maps of university campuses that include restaurant locations and Wi-Fi hot spots. Additional modules provide access to university news and lecture podcasts. The service is free for students.

The UnivMobile project provides administrative support for teachers by facilitating and streamlining communication with students. Teachers can quickly send information about class schedules and exam dates, post test results and grades, and respond to student messages through an easy-to-use system that is accessible via mobile devices. Teachers can also upload podcasts of their lectures for students who have missed class or would like to review the lecture.

MOBILSKOLE (NORWAY)

The Mobilskole (Mobile School) project in Norway offers a Short Message Service (SMS) system to primary and secondary schools that improves and simplifies communication between teachers, administrators, students and parents. Teachers and administrators can use Mobilskole from their mobile devices to quickly and easily send information to parents and students about attendance, grades and school events, among other things. Mobilskole can be used for urgent communication between schools and parents about emergencies and school closures due to weather. Because Mobileskole is a two-way communication system, it can also be used to gather feedback from parents.

Approximately 200 schools in Norway are currently using the Mobilskole system to streamline communication in a variety of ways. At Haugerud Skole in Olso, SMS messages are used to provide a secure channel for communication between the school and parents, particularly in relation to truancy and other behavioural issues. The school uses a positive approach to communication, providing parents with supportive messages and positive reinforcement about their children's performance and behaviour, rather than negative feedback. The school has reported that using Mobilskole has had a positive impact on attendance in all grades. Schools in the Hallingdal district use Mobilskole in conjunction with their school management system to send SMS messages from computers, so that teachers' mobile phone numbers remain private. The system provides templates for standard messages, including reminders for parents, information about school field trips, and internal

communications among school employees. At Veitvet Skole in Oslo, Mobileskole has become the main communication link between teachers and parents. Teachers send simple messages, such as reminders about warm clothes for outdoor activities and notices about school events, to keep parents informed and engaged in the school community. The school has noted that parental cooperation has improved since the Mobilskole system was implemented, and attendance at parent evenings has risen from around 60% to over 80%. Building on its success in Norway, the Mobilskole project has recently expanded to Sweden, with a pilot implementation in one secondary school launched in February 2012 (Kalbakk, 2012).

YORKSHIRE COAST COLLEGE (UK)

Yorkshire Coast College in Scarborough, UK, launched a project to explore how text messaging can be used to support students outside of class and increase student retention rates. The SMS system developed by the college provides a simple dialogue mechanism that enables teachers and staff to be more responsive to students' needs.

The system works using keywords. Students send a text message to the college's SMS number, which triggers an email to the appropriate person or department depending on the keywords used. For example, a text message from a student containing the word 'safe' will automatically generate an email to the college welfare team, which enables the welfare team to contact the student quickly and directly. Similarly, an email can be sent to a specific teacher if a text message contains the teacher's name and that name has already been registered in the system as a keyword. Another feature allows students to subscribe to certain keyword messages from the college. For example, students who register for the keyword 'snow' will be added to a mailing list for mobile updates about bad weather in the winter.

Teachers can use the system to set up class mailing lists that distribute information to students on their mobile phones. The system is synchronized with the college's information management system, so that teachers can send text messages to students without having to log in separately to the SMS system. The timing of texts can be set in advance, so that reminders about homework and exams can be sent to students automatically. Messages from students are sent as both emails and texts, so teachers can receive and access messages from their personal computer as well as their mobile device.

The cost of the SMS system to the college has been relatively low – approximately £1,000 per year for the software and five to six pence per text. These expenses can be balanced against the reduced costs for other forms of communications, such as phone calls and letters. The college reports that the cost of sending text messages appears not to be a deterrent for students, and the majority of students prefer to communicate with teachers and staff in this way. The SMS system enables the college to respond to students more quickly, using methods that students prefer. Researchers have noted that the system has resulted in improved student welfare and increased retention rates (JISC RSC-YH, 2011).

Yorkshire Coast College's network manager sees text messaging as a transitory medium that other forms of communication, such as Twitter, will eventually overtake. However, until the majority of students have smartphones with affordable internet access, the college will continue to use the SMS system.

MOBILE OXFORD (UK)

Mobile Oxford is a mobile application that, according to the project's website, 'puts Oxford University in your pocket' (University of Oxford, 2009). Launched in 2009, the application provides students with mobile access to the university's learning platform and podcasts of lectures. However, the major focus of Mobile Oxford is on providing the university's students, staff and visitors with practical information and administrative support. For example, the application allows users to search for lecture schedules, locate library books, find information about university events, and access local bus timetables, maps and restaurant listings.

The Mobile Oxford system uses Molly, an open source web-based application framework that works with both standard mobile phones and smartphones. Normally, native applications can only target a few types of devices, leaving a large number of potential users unable to use the service. However, wherever possible, Molly detects the device being used and tailors pages to match the phone's capabilities. Molly was developed by the University of Oxford to enable and encourage students and teachers to use their personal mobile devices to access information through Mobile Oxford.

INSTRUCTIONAL SUPPORT

The overwhelming majority of mobile learning projects in Europe are targeted at students. The various projects described below all aim to assist teachers in supporting student learning both in and outside of classroom and school environments.

MOBILE IN SALFORD (UK)

Mobile in Salford was a MoLeNET project that involved four colleges in the UK – Eccles, Salford, Pendleton and Langdon – as well as the Salford City Learning Centre (Hickey, 2009). The project explored the use of 3G mobile devices to enhance learning in and outside of college. Project objectives included the integration of mobile devices with the colleges' learning management systems, and the use of mobile-accessed closed social networks – social networks that are only open to a specific group of people – to promote collaborative learning among students from all four participating colleges. The project supported teachers' classroom practice primarily by allowing them to access their college's learning management system from their mobile phones.

The project's results offer several useful lessons for educators and policy-makers interested in developing mobile learning programmes. Project evaluators noted that while some students were immediately enthusiastic using mobile technology and immersed themselves in learning about the functionalities of their phones, others were less confident and sometimes felt overwhelmed by the tasks involved. As in many other circumstances, less confident students were inclined to step back and allow others to lead. Researchers concluded that more time was needed prior to implementation to allow some students to receive instruction and support in the use of mobile devices; it should not be presumed that all students are comfortable with mobile technology. Some teachers were not accustomed to working with mobile technologies

either, and researchers found that these teachers needed to plan additional time prior to lessons to download files like quizzes or instructions. Extra time was also necessary at the end of lessons to transfer images captured with mobile devices or to upload information from devices to the college's learning management system. One of the participating institutions, Pendleton College, reported that the production of digital materials for use on mobile devices was particularly time-consuming and could have a negative impact on teaching practice by taking time away from other work.

PRESEMO (FINLAND)

Presemo is a mobile learning initiative developed by the Helsinki Institute for Information Technology (HIIT), a joint research institution of Aalto University and the University of Helsinki in Finland. The project began in 2009 and is led by Kai Kuikkaniemi at HIIT. Presemo focuses on developing mobile participation platforms that teachers can use during lectures to support greater interactivity, communication and collaboration among students. Presemo also aids teachers in organizing assessments and collecting information and feedback from all students in a class. Students can use the Presemo platform and the web browsers on their mobile phones to interact with other students in the class, while the teacher manages student activity through a mobile device or laptop. The platform is built on modern web technologies (Node.JS, XMPP, Javascript), which means that students need smartphones with web browsers to participate in Presemo activities. Teachers can use a web-only version as well as a native client built on the Mac OSX operating system to access the system.

Presemo acts as extension of the teacher's presentation capabilities and pedagogical tools. Students access the system via their mobile web browsers, but they can only interact in ways that the teacher has determined for that particular lesson. The Presemo system allows the teacher to choose the most appropriate pedagogic approach for a given set of circumstances. Teachers can use Presemo to ask questions and solicit feedback from large groups of students during lectures. The user interface is designed to enable teachers to manage significant amounts of incoming information from students while maintaining the flow of their presentations.

Presemo has been tested in more than fifty presentation events and is currently in a development phase that focuses on enabling wider adoption. Because the tool is best-suited to large class sizes, most of the development tests have taken place in higher education, with a few tests carried out in secondary schools.

WAPEDUC (FRANCE)

The WapEduc project was started in 2005 by Philippe Steger, a secondary-school teacher in Montpellier, France, to provide 'anytime, anywhere' learning for his students. WapEduc has since grown to support students throughout France who are studying for their baccalaureate, a series of exams required for secondary-school graduation. A reported 32,000 students used the system in its first three years of operation. WapEduc is funded by the Montpellier Local Education Authority, and access to its materials is free for both teachers and students, though users must consider the costs of downloading data based on their personal mobile contracts.

WapEduc is a mobile platform that provides course materials, quizzes and tutoring for students preparing for their baccalaureate exams. Teachers and students can download specific applications to their smartphones to access the materials. The platform also includes problem pages, advice columns and interactive questions to allow students to monitor their own learning. In addition to accessing materials, students can build a personal mobile portfolio by uploading records of their progress.

Teachers can use the system to access over 110 lessons that align with the French curriculum to help students prepare for their exams. Teachers are also able to upload their own resources to the WapEduc site using any internet-connected computer and make those materials available to their students. The WapEduc system also supports SMS and email to enable communication and collaboration between students and teachers outside of class.

UNIVERSITY OF LEEDS MEDICAL SCHOOL (UK)

The School of Medicine at the University of Leeds in the UK recently began issuing smartphones to all fourth- and fifth-year medical students. At this stage in the Leeds medical degree, students spend up to 80% of their time in clinical practice, working at National Health Service (NHS) hospitals, general practitioner surgeries and community health clinics (Frith, 2011). The main objective of the project is to support students' learning at their clinical sites. The initial phase of the project targets 520 students. The university provided each student with an iPhone 3GS pre-loaded with applications developed specifically for the project, as well as unlimited mobile broadband connectivity. Phone calls and text messaging services are available on a pay-as-you-go basis.

The project aims to resolve specific issues that students encounter while completing their clinical practice. The university has reported that fourth- and fifth-year students often find it difficult to keep in regular contact with their teachers and to carry around the appropriate resources and manuals while they are at their work placements. They can now use the university-provided smartphones to access resources and assessment modules and to communicate with teachers. MedHand, a digital medical reference provider, developed mobile applications to provide digital versions of key medical textbooks and references works, such as the Oxford Handbook of Clinical Medicine and the British National Formulary (BNF) prescribing manual. MyKnowledgeMap, a UK-based company, created mobile applications that students can use to take notes on specific cases while working in hospital wards. The applications also contain assessment modules that allow students to test their knowledge of the procedures and protocols they have recently observed. The smartphone applications integrate notes and assessment results with the student's progress file to create an electronic portfolio (e-portfolio), which acts as a repository of information about the student's development that can be accessed by both students and teachers. Students can also use the phone's broadband connection to communicate regularly with teachers via email.

According to Gareth Frith, the Technology Enhanced Learning Manager at the University of Leeds, the project enables authentic and immediate assessment of medical students:

> The point is about being able to assess students close to the patient, close to the bedside, so that the student can be observed by a healthcare professional or a clinician or the lead nurse working

> with the patient. As soon as they finish [working with the patient] they can do an immediate assessment with the medical professional. (JISC, 2011)

Other benefits of the project include increased access to medical information for students, improved communication between students and teachers, and increased opportunities for students to record observations and engage in self-assessment and reflection. Improved hygiene in hospital wards has also been noted as an additional, unanticipated benefit of the project. While notepads, loose-leaf folders, textbooks, pens and pencils are difficult to clean and can harbour germs, the smartphones can be easily disinfected using antiseptic wipes.

DISTANCE LEARNING FOR APPRENTICES (DENMARK, GERMANY, PORTUGAL, SPAIN, TURKEY)

The Distance Learning for Apprentices project, active from 2008 to 2010, was supported by the Leonardo da Vinci Programme, which funds practical projects in Europe in the field of vocational education and training as part of the EU's Lifelong Learning Programme (European Commission, 2012). The project was led by Hansenberg, a Danish vocational college, in partnership with other vocational institutions in Denmark, Germany, Portugal, Spain and Turkey. The project used mobile technologies to support students engaged in distance learning as part of an apprenticeship training programme.

Distance Learning for Apprentices supported vocational education teachers in three ways. First, the project developed an online tool for mobile phones that allowed teachers to communicate with students, exchange information and monitor student progress. Second, a module called 'train-the-teacher' offered a pedagogical framework and technical advice for teachers who were incorporating mobile technologies into their instruction for the first time. Third, the project issued a general set of guidelines and recommendations for the use of mobile devices in distance learning and apprenticeship programmes, based on the project's outcomes. The guidance documents, project outcomes and learning materials have been published on the project's website, which may extend the impact of the project's works and inform future initiatives (Learning at Distance, n.d.).

PRIORY SCHOOL (UK)

The Priory School is an inner-city comprehensive secondary school in Portsmouth, UK. David Rogers, the Curriculum Leader for Geography at the school, has developed teaching practices and resources for using mobile technology to support learning. Some of his methods for using mobile devices to teach geography include asking students match music to locations or photographs, or create a soundtrack for a walk, to explore how they feel about certain places; and having students use the camera, audio recording and texting functions on mobile phones to capture images and sounds associated with a place, and post messages about their observations and associations (Rogers, 2011*a*). Rogers also recommends mobile applications like Photosynth, which allows users to stitch photos taken on mobile phones to create panoramas and upload them to social media sites and online maps. The resulting photos can be used to help students discuss and reflect on a particular location following a class field trip.

Rogers also spearheaded an effort to revise the school's mobile phone policy to allow the use of mobile devices during social time and encourage students to explore the possibilities for learning through their mobile phones. Taking an innovative approach to reform, Rogers co-developed the policy with students to help increase their sense of ownership and responsibility. The process is described in a video on Rogers' blog, in which he explained that the benefits of mobile learning are often obscured by the behavioural issues associated with mobile phone use in schools (Rogers, 2011*b*). Students agreed they before they could use mobile devices for learning, they first had to change people's perceptions. By helping design and implement the school's mobile phone policy, students are likely to be more committed to supporting and maintaining the policy, and teachers and administrators anticipate fewer behavioural problems associated with mobile phones.

APPS FOR GOOD (UK)

Apps for Good is a mobile learning project that aims to ignite a passion for technology and social enterprise among young people in the UK. Led by the non-profit organization CDI Europe, the programme offers a structured course designed for students between the ages of 14 and 25 in which young people identify a problem in their world and develop a mobile application that addresses the issue. The course teaches students basic computer programming and provides them with a foundation in entrepreneurship, community involvement, problem solving, mobile technology and teamwork, as well as technical and design skills.

The Apps for Good course uses a constructivist model of learning, in which students develop knowledge and understanding through experimentation and real-world problem solving. The course consists of five distinct stages:

1. **Problem discovery:** Students learn about mobile applications and the functionality of mobile phones. Through a series of exercises and puzzles, students develop their abilities to recognize market opportunities by reflecting on real-world problems and personal experiences.

2. **Research:** Working in teams, students investigate the problems they have identified and conduct interviews with key stakeholders to develop a better understanding of the context for their application. By the end of this stage, students should know who their target audience is and understand their users' needs and concerns. The research stage culminates in a 'pitch day', when ideas are scrutinized by an external team of design, development and business experts.

3. **Solution design:** Student teams develop a strategy for putting their idea into practice that includes marketing, distribution and business planning.

4. **Product design:** Once the solution design is complete, the student teams focus on finalizing their product and designing, testing and improving the feature sets and user interactions through feedback from potential users.

5. **Build and test:** Finally, using the Google App Inventor program, students work to create a prototype application, which is deployed onto AndroidMarket, the mobile application

store for smartphones on the Android operating system. Students then use real feedback from the public to test and redefine their application design.

CDI Europe ran the first pilot course in 2010 with a small group of young people outside a school setting, with the first school-based course following a few months later. In 2011 the course was launched in forty schools across the UK. It is generally run as an after-school club with the supervision of the school's librarian or information technology (IT) teacher. The level of teacher involvement usually depends on the type of relationship the school establishes with the Apps for Good programme. Schools can apply to be Content-only Partners, Affiliate Partners or Certified Partners. Content-only Partner schools have free access to online course content and tools in the Learning Zone portion of the Apps for Good website, designed for students, and teachers and students are guided through the process by a question-and-answer (Q&A) page. Affiliate Partners have access to the Learning Zone as well as the Educator Zone, designed for teachers, and schools benefit from online support from the Apps for Good Expert Community and CDI Europe staff. Certified Partners enjoy the highest level of guidance and support. Certified Partner schools select a teacher to be trained on course delivery through the Apps for Good 'train-the-trainer' programme. This teacher will also have access to ongoing support and professional development opportunities. Students will have more direct access to the Expert Community through Skype or in-person sessions, and CDI Europe staff will be available in person as well as online to help facilitate successful course implementation at the school.

While Apps for Good is still in the early stages of development, CDI Europe has been collecting data on the project's outcomes. It has been noted that, so far, 10–15% of Apps for Good alumni have expressed interest in becoming professional programmers, while more than two-thirds intend to explore careers in the broader fields of technology and software innovation. The Apps for Good model seems to be effective in helping young people develop technical skills as well as an understanding of the potential of mobile technologies to affect change.

BLACKBERRY ACADEMIC PROGRAM (MULTIPLE COUNTRIES)

The BlackBerry Academic Program provides educational resources that enable students to develop applications, manage BlackBerry devices and software, and learn more about BlackBerry technology. Like the Apps for Good project, a key component of this programme is teaching students to develop mobile applications to address real-world problems. A number of European universities are participating in the programme including Aston University in the UK and the Universidad de Oviedo in Spain.

Teachers who sign up for the BlackBerry Academic Program may be able to secure free BlackBerry devices for their institution. Teachers also have access to online forums as part of the programme's academic community, where they can share resources and discuss mobile learning strategies with over 400 academics in more than 60 countries around the world.

BlackBerry has also designed a 'Mobiles Made Simple' workshop aimed at 11- to 14-year-olds, which has been made available to some schools in the UK. The workshop explores the history and science of mobile telecommunications, using the BlackBerry as an example, and

includes a hands-on activity that allows pupils to take apart BlackBerry devices and identify key components, as well as a discussion about careers in science and technology.

REACH (ITALY, NORWAY, SPAIN, TURKEY)

The European project 'REACH the hard to reach: how to engage young learners in workplace training via mobile assisted learning' builds on the success of the BLOOM project, which stands for 'Bite-sized Learning Opportunities on Mobile Devices'. BLOOM, which ran between from 2008 to 2009, was a mobile learning project aimed at supporting lifelong learning for professionals in the transportation industry, such as taxi drivers and driving school instructors. The project designed mobile applications that could deliver basic skills training and job-related information in small increments, so that learners could access educational content and courses during downtime in their workday. BLOOM was funded by eTEN, a European Community Programme designed to expand the availability and use of services supported by the telecommunications networks in the European market. The BLOOM project was considered extremely successful, reaching over 25,000 people in 15 countries in Europe.

The REACH project is an adaptation of the BLOOM programme for use in vocational education and training (VET) centres and institutions. While BLOOM targeted learners who were operating completely outside traditional education environments, without access to teachers, REACH is more teacher-focused. One component of the project involves training VET teachers, trainers and counsellors in new pedagogical approaches to learning through the use of mobile technologies. The project aims to show educators how mobile learning can be used to increase participation among their students and motivate young learners. Funded by the European Commission, REACH is scheduled to run from 2011 to 2013 in Italy, Norway, Spain and Turkey.

ENVI GAME

The ENVI GAME project in the Czech Republic provides mobile learning platforms to support environmental education in schools. Students use Global Positioning System (GPS) enabled smartphones to play games through an internet-based platform. ENVI GAME learning activities combine outdoor observation, facilitated by the smartphone, with classroom-based computer use. The ENVI GAME platform has also been designed to improve communication among learners. The game is intended to be played in class and during after-school programmes to supplement teachers' environmental education curricula. The project was launched in late 2009, with pilot projects implemented in ten primary schools in 2010 and 2011.

RESEARCH

Rather than implementing specific programmes, some mobile learning projects have focused on providing research and advice on the use of mobile technologies in education. The Mobile Technologies in Lifelong Learning (MOTILL) project – a recent, large-scale, EU-funded

initiative – reviewed mobile learning projects aimed at lifelong learning in Hungary, Ireland, Italy and the UK and published a report about best practices for educators and policy-makers.

MOTILL (HUNGARY, IRELAND, ITALY, UK)

The MOTILL project was a year-long research project funded by the European Commission that focused on reviewing the use of mobile technologies to help to develop flexible lifelong learning standards for education and training. Rather than undertaking individual projects, MOTILL provided a methodological framework to analyse and highlight best practices in mobile learning. MOTILL's partners included the Italian National Research Council and three universities: Corvinus University of Budapest in Hungary, Trinity College of Dublin in Ireland, and the Open University in the UK. At the end of the project, MOTILL produced an up-to-date survey of the use of mobile technologies in learning and training projects in Italy, Hungary, Ireland and the UK. The survey took into account the policies for information and communications technology (ICT) and education established by governments and relevant institutions in the participating countries. MOTILL provided a meta-analysis of selected projects to highlight best practices in mobile learning that would be useful to key stakeholders, including school administrators, teachers and policy-makers. The project's findings were summarized in a MOTILL Best Practices booklet published in 2010 (Arrigo et al., 2010).

The Best Practices booklet provided reflections on the wide range of mobile learning projects for lifelong learning in Europe. The booklet noted that schools, universities and educators have been most active in main three areas related to mobile learning: 1) creating content specifically designed for mobile devices; 2) establishing new pedagogies and educational practices supported by mobile devices; and 3) designing tools and infrastructures to make content available via new channels and devices. MOTILL found that mobile technologies are used primarily as an additional access point for educational content and, at times, as a means of creating digital content. Few of the projects MOTILL identified enabled two-way communication to allow learners to interact with teachers, tutors and peers using mobile devices. At the same time, MOTILL observed that this type of interactive approach, with two-way communication at its heart, seems to have a positive impact on both learner motivation and the creation and reinforcement of social relationships. The primary challenge posed by this approach is that it requires strong support from IT specialists, as well as training for educators and administrators who may not feel comfortable with the technologies being used. MOTILL suggests that reluctance on the part of teachers and trainers to adopt mobile learning may jeopardize its success in the field of lifelong learning in Europe.

The MOTILL Best Practices booklet cites additional challenges to implementing mobile learning projects, including the high costs of purchasing and maintaining hardware and internet connectivity, the time and expense of training teachers and staff, and the legal barriers posed by digital content rights and online privacy regulations, which may need to be more clearly defined in order for schools and educators to ensure they are in compliance. The Best Practices booklet also reflects on the ethical issues that should be considered when designing or implementing mobile learning programmes. These issues include concerns about privacy and online safety, copyright infringement, and educational equity. Equity considerations are particularly important in developing mobile learning policies; although the majority of people in Europe own a mobile device, access is by no means universal, and the

cost of equipment and connectivity may be prohibitive for many students and families. It is essential that mobile learning initiatives are designed to promote social inclusion and narrow, rather than widen, the digital divide between students of different socio-economic backgrounds.

The MOTILL Best Practices booklet noted numerous benefits to the incorporation of mobile technologies into lifelong learning. One observation made by the project is that mobile technologies can play an important role in supporting learners who are changing their 'state' – moving between different grade levels or institutions, switching from individual to collaborative work, or even recovering from illness back to good health. Mobile learning can help provide continuity for learners during these periods of transition, when traditional educational opportunities may be unavailable. Additionally, the flexibility afforded by mobile learning, which makes learning possible from any location at any time, can encourage students to take more responsibility in directing and managing their own education. The ability to access learning opportunities outside the classroom can also help students contextualize and apply their learning in the real world. Finally, the networking and communication features offered by mobile technologies can help learners develop social skills and relationships by facilitating collaboration.

COMPARATIVE ANALYSIS OF INITIATIVES

The following sections compare and analyse the identified mobile learning initiatives in terms of their objectives and target populations.

OBJECTIVES

While many of the mobile learning projects reviewed for this paper have multiple educational goals, the projects' primary objectives can be grouped into three broad categories:

1. Facilitating research and collaboration in the field of mobile learning
2. Improving administration and communication through the use of mobile technologies
3. Enhancing instruction and improving pedagogical practices through mobile learning

Table 2. Mobile learning initiatives by objective

Objective	Initiative / Institution
Facilitating research and collaboration	MoLeNET MOTILL
Improving administration and communication	UnivMobile Mobilskole Yorkshire Coast College Mobile Oxford
Enhancing instruction and improving pedagogical practices	Mobile in Salford Presemo WapEduc University of Leeds Medical School Distance Learning for Apprentices Priory School Apps for Good BlackBerry Academic Program REACH ENVI GAME

FACILITATING RESEARCH AND COLLABORATION

The MoLeNET project in the UK sought to influence the skills sector as a whole by stimulating mobile learning activity through a wide variety of projects. Central funds were channelled through MoLeNET to selected projects, which were supported by a team of experts at the LSN, an educational non-profit organization. The LSN oversaw the individual projects and conducted evaluations of their outcomes and impact on student achievement and retention, among other things. LSN also enabled projects to share information with each other about strategies, challenges and successes. At the end of the MoLeNET programme, the LSN conducted a review of the overall initiative and shared the results widely, providing a valuable resource to educators and policy-makers.

The EU-funded MOTILL project also supplied key education stakeholders with important information on mobile learning. The project investigated how mobile technologies could impact learning by making knowledge accessible to all learners, regardless of socio-economic status, age, gender, religion, ethnicity or disability. MOTILL differed fundamentally from MoLeNET in that it did not finance the projects that it studied, focusing instead on identifying, describing and analysing new pedagogical approaches that exploit mobile technologies for lifelong learning. While MoLeNET projects were limited to the UK, MOTILL developed a database of projects unfolding in multiple countries throughout Europe. MOTILL evaluated and analysed the projects to create a review of best practices for mobile learning, which it published on its website (Arrigo et al., 2010). The MOTILL project aimed to create 'an open space for public discussions' that would raise awareness about mobile learning and encourage policy-makers to consider the benefits of using mobile technologies to support lifelong learning. The project was successful in bringing researchers together with national and local authorities to draft policies on mobile learning and to provide educators with the technological and methodological scaffolding necessary to implement those policies.

The strengths of the initiatives in this category include the provision of support and guidance for educators and policy-makers, the sharing of information among participating institutions, and the compilation of research and project outcomes to inform future practice and policies. Both projects also helped bring together key players, including educators, researchers and policy-makers, committed to exploring the potential of mobile learning to support students and teachers. However, more emphasis seems to have been placed on producing research and publishing case studies than on developing and sustaining human networks and communities that might work together to continue progress after the programmes ended.

IMPROVING ADMINISTRATION AND COMMUNICATION

The need for improved communication and administrative support in education is driving innovation in mobile learning applications. Universities appear to be leaders in using mobile phones to provide information to students and facilitate communication between teachers, students and parents, and several institutions have developed their own mobile platforms to address specific educational needs. The Mobile Oxford project stands out in its use of a web-based application framework (Molly) that targets all phones, both basic and smartphones. The application was designed by the University of Oxford to be able to detect the type of device being used and tailor its display accordingly. Clearly such a system makes the use of

personally owned mobile phones more feasible for mobile learning projects, because learners do not need to have a particular type of device to access the mobile platform.

Several commercial systems are also being used by schools and universities to facilitate communication and information-sharing among teachers, students and parents. Many schools in Norway, for example, use the Mobilskole system, which has just been adopted by a school in Sweden as well. The Blackboard ConnectTxt company (formerly txttools) worked with Yorkshire Coast College in the UK to develop a mobile system that would be compatible with the college's information management system. The mobile platform was designed to recognize keywords sent via text message to the college's SMS number and respond by triggering an email to the appropriate staff or department.

All of these projects address personal, local, contextual or institutional needs. Some projects have seen immediate results: at Yorkshire Coast College, increased communication and information-sharing has reduced demands on student welfare services and other departments, allowing resources to be allocated where they are most needed. Other projects have been slower in gaining support. In some cases extending system access to the public, as the Mobile Oxford project has done, may help sustain and earn support for the project and for mobile learning in general. Services that provide valuable information via mobile devices will encourage the use of mobile technologies for educational purposes. Competition among commercial companies for students and institutions may also drive innovation and development in mobile applications and platforms.

ENHANCING INSTRUCTION AND IMPROVING PEDAGOGICAL PRACTICES

Many of the mobile learning projects identified aim to enhance instruction and encourage new pedagogical practices. These projects take place in a wide range of institutions, including primary and secondary schools, universities and colleges, and VET centres. Some projects, like WapEduc in France and the Priory School's geography programme in the UK, address very particular areas of the curriculum. WapEduc is designed to help secondary-school students prepare for their baccalaureate exams, while the Priory School's major mobile learning activities have been developed by a single teacher specifically to help students learn geography. Other projects, like Apps for Good, introduce new pedagogical models, based on constructivist or experiential learning, that tend to be more student-centred, collaborative and interactive than traditional learning models.

At the university level, the Presemo project in Finland offers teachers new tools for making lectures more interactive. In order to use the system successfully, teachers may need to change their pedagogical approach to account for more student participation and significantly increased feedback from their audience, which may be difficult to manage at first. While this challenge is not trivial, teachers who use the system successfully may see higher levels of student engagement and motivation as a result of more interactive and student-centred teaching strategies.

A number of projects were also identified at the university and VET levels that aim to support students in a work or professional training setting. A range of mobile services offer remote access to educational materials and communication with teachers and trainers. At the University of Leeds in the UK, medical students engaged in clinical practice use university-

provided mobile devices to reference textbooks and manuals, record notes on specific cases, test their knowledge of new procedures, and send emails to their professors. Mobile technologies have the potential to support professional training, continuing education and lifelong learning by allowing students to access learning opportunities and maintain educational momentum while participating in the workforce.

A focus on pedagogy may help to develop approaches to mobile learning that are more effective in meeting local needs. However, smaller projects led by individual teachers, like the Priory School programme, may falter or lose momentum when those individuals move on. It is also unusual to find rigorous evaluation of small-scale projects, and it may not be clear whether project outcomes are replicable.

TARGET POPULATIONS

The mobile learning projects identified in this review also vary in terms of their education level and target populations. Some projects are focused on students and teachers in primary and secondary schools, while other target higher education and lifelong learning. A few projects, such as MoLeNET and the BlackBerry Academic Program, span multiple education levels, targeting young people and their teachers at both secondary schools and universities.

Table 3. Mobile learning initiatives by target population

Target population	Initiative / Institution
Primary- and secondary-school students and teachers	MoLeNET Mobilskole WapEduc Priory School Apps for Good BlackBerry Academic Program ENVI GAME
University students and teachers	MoLeNET BlackBerry Academic Program UnivMobile Yorkshire Coast College Mobile Oxford Mobile in Salford Presemo University of Leeds Medical School
Vocational education trainees and lifelong learners	Distance Learning for Apprentices REACH MOTILL

The majority of mobile learning projects are aimed at older learners – university students, medical students, working professionals participating in career training and other adults engaged in lifelong learning. This may be due to the higher penetration rate of mobile phones among adults as well as the greater maturity level of the learners in relation to younger students at the primary and secondary education levels. In general, it seems reasonable to assume that mobile phone ownership is more widespread among older students than among schoolchildren. Older students may also be viewed as more responsible in their mobile phone use, which makes it less likely that mobile devices will disrupt the learning process or cause behavioural problems. The mobile learning programmes that do target primary and secondary education often focus on improving communication between adults (i.e. teachers and parents), like the Mobilskole project in Norway. Mobile learning may also be more prevalent at the postsecondary level because many learners have jobs or clinical work that makes it difficult for them to attend formal classes in a traditional educational setting. Projects like Distance Learning for Apprentices and the University of Leeds Medical School's smartphone programme make it possible for students to access educational tools and communicate with teachers and trainers while working at their job sites.

FACTORS INFLUENCING MOBILE LEARNING

DRIVERS, ENABLERS AND SUCCESS FACTORS

Key drivers for the mobile learning projects reviewed in this paper include a desire on the part of governments and the EU to encourage lifelong learning; the need for improved communication between teachers, administrators, students and parents; and national and local goals for increasing student achievement and reducing drop-out rates. Specific projects focused on using mobile devices to a) provide students with increased access to learning opportunities in non-traditional settings (such as the workplace); b) improve channels of communication at universities and schools; and c) engage and motivate students by making learning more relevant and enjoyable.

The primary enablers for mobile learning are widespread mobile phone ownership and familiarity with mobile devices. Many mobile learning projects have been able to take advantage of the ubiquity of mobile phones to develop programmes in which students and teachers use their own devices to participate in learning activities. The benefits to this approach include reduced costs for equipment and connectivity and well as decreased expenditures for training, as most teachers and students already know how to use their own mobile devices. However, the use of personally owned mobile phones for learning at school has the potential to introduce inequities. Some students may own phones and others may not, and of the students that do have phones, some may own a smartphone while others have only a basic mobile phone. Also, some students may have mobile contracts that allow for high volumes of data, calls and texts, while other may have more limited plans. If a school, college or university provides the mobile devices used for learning, then equity issues can be avoided; however, the cost of providing devices and accompanying data plans may make it difficult to sustain or expand programmes. Under these circumstances, it seems remiss to ignore the potential of student-owned devices when planning mobile learning initiatives, though equity concerns must be addressed directly for projects to be successful.

A key success factor for the adoption of mobile learning is national or regional support, mainly in the form of public funding and guidelines for mobile learning, technology use and digital content development. The MoLeNET and MOTILL projects, two of the largest mobile learning projects in Europe, were financed by the UK government and the EU's European Commission, respectively. The MOTILL project published a collection of best practices that may help policy-makers and educators develop other mobile learning projects in the future. In the UK, the national government has supported mobile learning since the late 1990s, which may be why so many of the projects identified in this review are located in the UK. The existence of national curricula may also help guide the development of digital content for mobile devices and allow commercial developers to focus on particular subject areas and skills. However, where the national curriculum is tightly controlled, it may limit innovation and development. Researchers have found that where there is greater autonomy in schools,

there are greater opportunities for school-based innovation (GSMA, 2011). Yet under these circumstances there is also a risk that a patchwork of 'home-grown' projects will develop rather than something more systemic. To maximize the success of mobile learning initiatives, it is important to establish a balance between national guidance and local control.

BARRIERS

The main barriers to mobile learning are the high costs associated with equipment, connectivity, maintenance, technical support and teacher training; and negative social attitudes about the use of mobile phones in schools.

HIGH COSTS

The cost of purchasing mobile devices for students and maintaining mobile subscriptions for each devices may limit an institution's ability to adopt large-scale mobile learning programmes. Concerns about the ability to control costs may also cause educators to be reluctant about encouraging mobile learning at their schools. For example, a secondary school in Scotland implemented a mobile learning pilot project in which students were provided with mobile devices to use for school projects and language learning. According to a teacher at the school who blogged about the project, the phones were supposed to have a £5 limit, but this turned out not to be the case. She explained:

> Give a bunch of 17-year-olds a phone and say there is £5 of credit before cutting off and they will use it. We encouraged them to use it. We were happy for them to be using the phones. The kids did point out they felt they had been using [the phones] a lot so we checked up and were assured by the company that there was a £5 cut-off in place. There wasn't. I don't know the exact figure, but I believe it was pretty scary. (Farrell, 2008)

Resolving these charges with the service provider took a great deal of time and energy and ultimately diminished the teachers' and students' enthusiasm for mobile learning, and the project was eventually abandoned. This example illustrates the importance of careful budget planning and cost management when designing and implementing mobile learning projects with school-provided devices.

Additional expenses for mobile learning projects include replacing hardware and software, which quickly become obsolete due to technological advancements; training teachers and other staff members who may be unfamiliar with using mobile technologies to support instruction; and paying for digital rights to educational content.

NEGATIVE SOCIAL ATTITUDES

Negative social attitudes form another impediment to mobile learning, as many policy-makers, educators, parents and perhaps even students themselves are concerned about student behaviour in relation to mobile phones. Research and anecdotal evidence suggest that a majority of people in Europe see mobile phones as a potentially disruptive force in

education, and many people believe that mobile devices have no place in schools. For example, Directgov, the UK government's digital service for England and Wales, states on its website that:

> Schools have a legal right to impose reasonable sanctions if a pupil misbehaves. Sanctions a school might use include…confiscating something belonging to your child if it's inappropriate for school (for example, a mobile phone or music player). (Directgov, n.d.)

Policies like these reinforce the view that mobile phones are inappropriate for school. However, there is some evidence that the supposed link between mobile phones and poor student behaviour does not hold true in practice. At the beginning of some of the MoLeNET projects, teachers reported worrying about students texting in class, using mobile phones for cheating and cyber-bullying, or selling the school-provided devices and reporting them as lost or stolen. According to project evaluations, however, student behaviour actually improved as a result of using mobile devices for learning, and students seemed to be more engaged in the learning process in general. Nevertheless, concerns about inappropriate behaviours like cheating and cyber-bullying, as well as student safety and privacy online, need to be addressed directly when developing a mobile learning programme, especially for use in primary and secondary education. These concerns tend to be reduced at the higher education levels as learners become more mature and responsible for their own behaviour.

CONCLUSION

Mobile technologies are developing rapidly, and the functionalities available on mobile devices grow more numerous and complex every day. These technological advancements, coupled with the widespread availability and relatively low cost of mobile devices, represent a tremendous opportunity to leverage the power and ubiquity of mobile technologies to enhance learning and extend educational opportunities. Many innovative researchers, educators, policy-makers and entrepreneurs have experimented with different ways of using mobile devices to support learning in Europe. The initiatives highlighted in this report reflect only some of the myriad approaches to mobile learning that are being implemented in Europe and throughout the world today.

The identified initiatives offer a number of insights for educators and policy-makers interested in developing and implementing mobile learning programmes in the future. Among the various success factors, national or regional leadership and central funding seem to be key elements in allowing projects to continue and expand. The majority of mobile learning projects are small-scale and rarely extend with beyond a single institution. Large-scale programmes that involve multiple schools or span several countries are typically supported by funding from the EU, national governments or private companies.

It is also interesting to note that while the identified mobile learning projects used a range of devices, they rarely focused exclusively on mobile technologies. When considering an approach to mobile learning, it is important to first identify the central learning activities involved, and then select the most appropriate tools to support those activities. These tools might include a range of technologies and pedagogical strategies. It is also necessary to consider which mobile technologies are best-suited to the project. For example, if the project is planned to support simple communication, then a basic mobile phone with text and voice capabilities may be sufficient. If students and teachers need to access the internet, then a more sophisticated device, such as a smartphone with wireless connectivity, will probably be required. Smartphones will also be necessary if students need to take notes, capture images, and record videos and sound, as these functions are not generally available or easy to use on standard mobile phones.

Due to their increased capabilities and higher connectivity standards, smartphones are likely to outnumber basic mobile devices in mobile learning projects. However, as with any approach to ICT in education, cost must be taken into consideration. Smartphones are significantly more expensive than standard mobile phones, and expenditures for mobile broadband can also be substantial. Institution-based mobile learning programmes must take equity issues into consideration when deciding whether to encourage students to use their own devices for learning, as some students may not have access to devices, and those who do may own standard phones rather than smartphones. The type of device and mobile platform to be used is also a critical decision for companies and organizations that develop mobile learning applications; few applications can be used on a range of devices, though this situation may change in the future.

REFERENCES

Arrigo, M., Di Giuseppe, O., Fulantelli, G., Gentile, M., Merlo, G., Seta, L. and Taibi, D. (eds) 2010. *MOTILL: Mobile Technologies in Lifelong Learning – Best Practices*. Palermo, Italian National Research Council – Institute for Educational Technology. http://www.motill.eu/images/stories/motillbooklet_en.pdf (Accessed February, 2012.)

Directgov, n.d. *School discipline and exclusions*. http://www.direct.gov.uk/en/Parents/Schoolslearninganddevelopment/YourChildsWelfareAtSchool/DG_4016112 (Accessed October 2011.)

Douch R., Savill-Smith C., Parker G. and Attewell J. 2010. *Work-based and vocational mobile learning: Making IT work*. London, LSN. http://issuu.com/steveb123/docs/100186

European Commission. 2012. *Leonardo da Vinci programme*. 02 March 2012. http://ec.europa.eu/education/lifelong-learning-programme/ldv_en.htm (Accessed April 2012.)

Farrell, K. 2008. Mobile Learning Trial: a reflection? *Digitalkatie's blog*. 24 May 2008. http://digitalkatie.typepad.com/blog/2008/05/mobile-learning-trial---what-went-right.html

Frith, G. 2011. The Smartphone – More than just an iPhone. *Medicine Matters*, Issue 32, January 2011. Leeds, UK, University of Leeds School of Medicine. http://www.leeds.ac.uk/medicine/alumni/articles/2011_jan_phones.html

GSM Association (GSMA). 2011. *Embedded Mobile Guidelines*, Version 2, March 2011. London, GSMA. http://www.gsma.com/documents/embedded-mobile-guidelines/21437/

Hickey, K. 2009. MoLeNET in the NorthWest. *New Learning*. 17 July 2009. http://newlearning.wordpress.com/tag/molenet/ (Accessed April 2012.)

JISC. 2011. Case study 7: Assessment and learning in practice settings (ALPS). Centre for Excellence in Teaching and Learning, Universities of Leeds, Bradford and Huddersfield, Leeds Metropolitan and York St John Universities. *Emerging Practice in a Digital Age Case Studies*. London, Higher Education Funding Council for England (HEFCE). http://www.jisc.ac.uk/media/documents/programmes/elearning/digiemerge/7_JISC_EmPDA_ALPS.pdf (Accessed April 2012.)

JISC Regional Support Centre for Yorkshire and Humber (RSC-YH). 2011. *Yorkshire Coast College: The educational impact of SMS on safeguarding and retention. An Excellence Gateway case study*. 11 February 2011. Learning and Skills Improvement Service (LSIS). http://www.excellencegateway.org.uk/272072 (Accessed October 2011.)

Kalbakk, H. 2012. *Mobilskole ekspanderer til Sverige!* [Mobile School is expanding to Sweden!]. 17 February 2102. Oslo, Mobilskole. http://www.mobilskole.no/mobilskole-ekspanderer-til-sverige/ (Accessed April 2012.)

Learning at Distance. n.d. *Welcome to Distance Learning for Apprentices*. http://www.learning-at-distance.eu/project/index.html (Accessed October 2011.)

mobiThinking. 2011. *Global mobile statistics 2011: all quality mobile marketing research, mobile Web stats, subscribers, ad revenue, usage, trends….* http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats (Accessed October 2011.)

Ofcom. 2011. *The Communications Market 2011 (August)*. http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr11/

Rogers, D. 2011*a*. Naughty Learning in Geography. *David Rogers: Geography. Teaching. Learning*. 17 June 2011. http://daviderogers.blogspot.com/2011/06/naughty-learning-in-geography-at.html (Accessed February 2012.)

Rogers, D. 2011*b*. Creating a mobile policy. *David Rogers: Geography. Teaching. Learning*. 1 October 2011. http://daviderogers.blogspot.com/2011/10/creating-mobile-policy.html (Accessed October 2011.)

University of Oxford. 2009. *Mobile service 'puts Oxford University in your pocket'*. 12 October 2009. Oxford, UK, University of Oxford. http://www.ox.ac.uk/media/news_releases_for_journalists/091012_1.html (Accessed April 2012.)

APPENDIX A: Countries surveyed

To collect information for this paper and to supplement other research, an email request for information about mobile learning was sent to individuals and organizations in the following countries. Responses were received from all countries except Belgium, Italy and Lithuania.

- Belgium
- Denmark
- Finland
- France
- Hungary
- Ireland
- Italy
- Lithuania
- Malta
- The Netherlands
- Norway
- Portugal
- Sweden
- United Kingdom (Scotland and England)

APPENDIX B: Email sent to education and technology experts

The email sent to education and technology experts asked for the following information:

1. What are the major mobile learning initiatives in the region and in your country, in particular? What are their main characteristics and results?

2. Which people or organizations are leading the initiative(s)?

3. What are the main objectives of the work, and what is its context?

4. What are the pedagogical and technological components?

5. What strategies are used to encourage local ownership, and are there any incentives for teachers and learners to adopt the initiative(s)?

6. For each initiative, what are the main:

   Drivers?

   Enablers?

   Barriers?

   Success factors?

7. What opportunities are there for scaling up the initiative(s)?

APPENDIX C: Mobile learning project websites

The following mobile learning project websites were consulted for this review. Unless otherwise noted, websites were accessed in October 2011.

Apps for Good:	http://appsforgood.org/about/
BlackBerry Academic Program:	http://us.blackberry.com/ataglance/academic/
BLOOM:	http://www.bloom-eten.org (accessed February 2012)
Distance Learning for Apprentices:	http://www.learning-at-distance.eu/project/index.html
ENVI GAME:	http://www.envigame.cz/
Mobile Oxford:	http://m.ox.ac.uk/desktop/
Mobilskole:	http://www.mobilskole.no/
MoLeNET:	www.molenet.org.uk (no longer active)
MOTILL:	http://www.motill.eu/ (accessed February 2012)
Presemo:	http://www.hiit.fi/presemo (accessed April 2012)
Priory School:	http://daviderogers.blogspot.com/
REACH:	http://www.reach-project.eu/en/welcome (accessed April 2012)
UnivMobile:	http://www.univmobile.fr/ (accessed April 2012)
WapEduc 2.0:	http://www.wapeduc.net/

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 Europe. 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, Latin America, 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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http://www.unesco.org/new/en/unesco/themes/icts/m4ed/

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