Mobile Education

The Mobile Proposition for Education

Describing key educational scenarios where the use of mobile-enabled handheld technologies can deliver significant benefits and the assets and expertise the mobile ecosystem can offer the education sector.

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1. Introduction and executive summary

1.1 What do we mean by mobile education?

"Mobile learning" takes place when a student uses portable devices, such as smartphones, netbooks or tablets, or handheld gaming devices, to access learning materials and systems, create content and interact with other students, teachers, learning systems and the world around them. Mobile devices enable learning to take place at any time in any location, at a pace chosen by the learner whilst enabling teachers to easily provide personalised and motivating learning experiences relevant to location and context. Mobile learning can be individual or collaborative and transformational.

"Mobile Education" is an extension of mobile learning, including the full range of opportunities mobile technologies and systems offer for improving learning, teaching, assessment and educational administration and management. Mobile education incorporates access to e-books and online learning materials and systems, collaboration, learner-tutor communication, evidence collection, e-portfolios, e-assessment, attendance monitoring, task planning, curriculum and device management.

The "mobile" in mobile education refers to the technologies used by students and teachers to teach or learn in different locations which can be connected to the mobile networks provided by mobile network operators (MNOs). This enables communication and access to online resources from most locations inside and outside buildings and throughout the world, including those beyond the reach of institutional and public wireless networks.

At the moment the technologies used for mobile education are generally consumer devices such as those listed above, but there is potential to embed mobile connectivity into other equipment thereby opening up new and exciting innovative teaching and learning opportunities. Examples include connected science equipment which can take readings and upload the data in real-time, saving time and increasing accuracy.

This paper explores how mobile education solutions can be harnessed by institutions offering any form of organised or formal education. These include schools, universities, colleges, adult education and community based learning centres, centres offering professional qualifications, work-based learning providers and employers.

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1.2 The mobile education landscape

Increasingly, societies and individuals around the world are recognising that investment in education is an investment in their future growth and economic prosperity. Mobile connectivity provides the opportunity to offer new ways of teaching and learning that are cost-effective and can create programmes of education that can be better personalised to the needs and location of the individual, thereby improving performance and results.

In most OECD countries, annual public expenditure on education represents between 4% and 5% of GDP, according to an OECD report published in 2007. Overall global expenditure on education was $2.5 trillion in 2004 and there were 1.4 billion enrolled students in 2008, according to UNESCO. Economic growth, expanding populations and a rising middle class are all driving demand for education in both developed and emerging economies. The education sector spends a greater percentage of revenue on technology than many other industries - 5.5% compared to an overall average of 4.2%, according to analyst firm Forrester. Global education IT spend was $64.15 billion in 2010, achieving 2.5% annual growth even after the financial crisis, according to analysts at Gartner.

The growing adoption of smartphones, tablets, portable gaming machines and other handheld devices by individuals is building a potentially compelling learning platform that could be harnessed by a significant proportion of the education market. Mobile technologies can also be used collectively to enhance group-based teaching and learning either within an institution or in out-of-classroom scenarios.

1.3 The benefits of mobile education

Harnessing mobile devices to deliver education has a wide range of benefits including:

- Learners have continuous access to the latest textbooks, podcasts, videos and multimedia learning experiences sourced from around the world and can choose when and where to work.
- Assignments and coursework, combining text, images, audio and video, can be created on a mobile device and can be all gathered together in an online portfolio by the learner.
- Students (and educators) are able to connect with each other anywhere and at any time to discuss and explore their learning together.
- Students (and educators) can interact with people pursuing similar disciplines across the world thus building global communities of learning and practice.
- Using mobile devices to introduce topics and run assessments means teachers can reduce the amount of time they spend in front of a class presenting and testing knowledge, freeing up more time for discussion and exploration.
- Information and feedback can be easily sent directly to learners, teachers, tutors, parents, etc., and quickly acknowledged and followed up.
- Online planning systems can use mobile devices to co-ordinate and send reminders about classes, workshops, events and vacations.
- Test papers can be assessed, collated, aggregated and graded safely and securely when students are ready rather than at set times during the year.
- For many people, especially children and teenagers, the use of mobile devices is inherently exciting, motivating and, if properly structured and supported, can help to build confidence and engage students from hard-to-reach groups and improve their performance.
- Mobile education can be more cost-effective than traditional approaches, enabling the efficient use of accommodation and staff time, and saving money, for example, on photocopying, printing, postage, textbooks and staff travel.
- Mobile technologies make it easier for teachers to provide more differentiated learning experiences and formative assessment for learners of different abilities and with different learning styles or preferences.
- Mobile connected equipment can make data collection by students, inside or outside of the classroom, easier and more accurate.

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2. Key scenarios for mobile education

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2.1 Vocational education and training

Many vocational education courses, such as training to be a plumber, engineer, chef or hairdresser, require a combination of in-classroom tuition and practical on-site experience. Mobile devices, such as smartphones, tablets, netbooks or e-readers, give trainees on such courses continuous access to relevant learning materials both in the classroom and at the on-site location. These devices are also used by trainees to document their work and share observations.

Accessing learning materials from remote locations

With a connected mobile device, trainees are able to download learning materials or manuals while in the classroom and then take that content with them to practical sessions in areas without reliable 3G or Wi-Fi connectivity, where they can use it for reference as necessary. The trainee could use these same devices during the practical sessions to get online to find missing information or seek advice.

Augmented reality (AR) apps, which overlay images of the real world captured by a device's camera, with digital information, could also be powerful learning tools. For example, an augmented reality app could help a trainee plumber identify the different components of a washing machine and provide links to more information online.

Further benefits of having continuous access to course content include:

- The ability to double-check information in real-time, resulting in a lower probability of trainees making errors during practical sessions.
- The ability to immediately access the theory behind practical skills.
- The ability to read and revise theory coursework during quiet times at work and in transit.
- Less time required to complete the theory aspects of training.
- Reduced paper and photocopying costs.

Documenting work while on site

Students can use mobile devices to collect evidence of practical experience in real-time. They can, for example, take a photo, or shoot a video, of their work and upload it to their institution's servers, virtual learning environment (VLE) or e-portfolio system. Or they could use a mobile device to keep written or verbal diaries reflecting on their learning. Where appropriate, teachers and assessors can give real-time feedback or use the uploaded content as the basis of regular assessments.

Further benefits of being able to use mobile devices to capture and upload evidence of learning and create content for coursework on-site include:

- Teachers, students and assessors having immediate access to a portfolio of practical work for formative and summative assessment with the ability to accurately track the process by which students reach outcomes.
- More efficient assessment processes, so fewer on-site assessor visits, and reduced assessor paperwork burden.
- The systematic creation of a portfolio of evidence of practical work that potential employers can review.
- Neater, easier to read and more secure folders of coursework and assessment evidence.

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Sharing information in real-time

Mobile devices enable trainees undertaking practical work at different locations to collaborate and share their experiences in real-time. Students can use the devices to ask each other questions, swap tips or offer encouragement. Where appropriate, they can also post queries on discussion boards or social networks in real-time.

Further benefits of being able to share content include:

- Students feel less isolated and better supported when doing practical work in different locations.
- Trainees can use mobile devices to ask teachers questions by text message or voice call.
- Institutions find it easier to engage employers in their employees' learning processes.
- Enhancing institutions' reputations as modern and innovative organisations, and therefore their ability to attract learners and employer clients.

Socio-economic benefits

In summary, the widespread use of mobile devices could make vocational training more effective and efficient, potentially freeing up resources and improving productivity across the economy as a whole.

The broader benefits of using mobile devices to support vocational education and training include:

- A reduction in the time trainees need to spend in college, freeing-up more educational capacity and enabling students to spend more time gaining practical experience or doing productive work.
- Fewer students dropping out of vocational training courses and more students achieving qualifications.
- Less time spent on assessments resulting in less employee time off-site and less workplace disruption.

Examples of how mobile devices are being used in vocational training today

Supporting health and social care students on work placements, United Kingdom

Institution:
The ALPS (Assessment and Learning in Practice Settings) project

Location:
Five universities in the UK (Leeds, Bradford, Huddersfield, Leeds Met and York St John)

Mobile devices used:
T-Mobile MDA Vario (a PDA style device) with mobile broadband access

To explore the benefits of mobile education the ALPS programme worked with 900 health and social care students from 5 universities in Yorkshire. The students were given mobile devices which (using software and the IT infrastructure developed as part of the ALPS programme) enabled them to access learning materials, submit assessments, communicate with tutors and upload assessments and reflections to their e-portfolio while on placements. Staff could also use the system to package and send learning materials and bespoke assessments directly to the students' mobile devices. The programme involved students from 16 different professions and the system allowed each profession to tailor the ALPS approach to fit their requirements.

This initiative meant that students could gather rich feedback, reflections and evidence for assessments during their practices placements, share these with their university tutors and therefore get timely and relevant support whilst they were away from university. The universities involved in the ALPS programme have all built on this work and enhanced their support for mobile learning – for example the School of Medicine at the University of Leeds now provides all 4th and 5th year students with iPhones, e-books, apps and web-based software to support their learning. Other universities are ensuring that their admin and teaching and learning systems can all be easily accessed by mobile devices – therefore enabling students to use their own mobile devices to learn at any time and in any place. Tutors are being encouraged to learn from the ALPS experience and develop teaching and learning activities and materials that make the most of this mobility.

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Encouraging engagement in schools

Institution:
Renaissance Academy – a distance learning high school

Location:
Daigo-cho, Ibaraki, Japan

Mobile devices used:
Smartphones

In July 2011, Qualcomm, through its Wireless Reach™ initiative, and Renaissance Academy announced the launch of an initiative to help high school dropouts, habitual absentees and students seeking vocational training to earn diplomas.

The project will provide smartphones, mobile educational content and 3G mobile connectivity to 500 Renaissance Academy students. The students will be able to use the smartphones to access educational content and resources through a 3G network.

Students also will be able to download educational applications and take lessons or tests anytime and anywhere using their smartphones. Renaissance expects this flexibility will help students maintain their motivation for learning as they work toward attaining the diploma they need to obtain steady jobs, thereby increasing the proportion of students completing programs.

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Supporting customer service training

Institution:
The Manchester College

Location:
North-West England

Mobile devices used:
Netbooks, smartphones, portable scanners, video cameras, digital notepads and digital recorders

The Manchester College provides customer service training for conductors, train drivers, signal and kiosk staff for the First Transpennine Express Train Company. The trainees work across the north west of England, so assessors spend a great deal of time travelling to visit them and difficulties arise when trainees have to rearrange appointments at short notice.

To tackle these challenges, The Manchester College ran a pilot project in which both assessors and trainees were issued with a business kit containing a netbook, a smartphone, a portable scanner, a video camera, a digital notepad and a digital recorder. Project participants used the netbook to write and upload evidence statements of their learning achievements into the College's e-portfolio online database using the smartphone as a modem, while the portable scanner was used to scan paper-based evidence into the e-portfolio system via the smartphone.

Professional discussions between the candidate and the assessor were recorded on the digital recorder and the digital notepad was used to write up observation and discussion statements which were uploaded to the e-portfolio system via the smartphone. Trainees and assessors could use the kit while in transit as well as during assessment visits.

In a survey, project participants said the kits were easy-to-use, portable, fast and efficient, enabling them to access learning anywhere and at any time. The overwhelming majority of candidates who participated in the research agreed that the equipment helped them to understand the learning materials better and that the mobile technologies helped them to complete tasks faster.

The report on the pilot, published in September 2010, stated: "The college has been recently asked to roll the work based learning programme out to the entire front line staff at First Transpennine Express Train company. As a result of the delivery expansion, an additional assessor will be brought in to provide a similar service using a similar mobile learning technology kit – this intervention has proved really productive and has come to stay."

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2.2 Consistent connectivity for children

Many children are educated at multiple locations across their school year or even during the same day or week. In addition to their regular schooling, they may attend after-school care or have specialist tuition. Their parents may be separated or they may have foster parents, meaning they divide their home time between different locations. In these circumstances, children may be forced to carry multiple books from place to place, while their ability to access the internet and online education resources may vary depending on their location. These factors can make it difficult to both children and their parents to consistently engage in their education.

The use of mobile devices, such as connected netbooks, tablets, e-readers and smartphones, can make it much easier for children (and their parents) to access both online and offline educational materials regardless of their location. Moreover, homework can be set electronically and personalised, while children can use a netbook or a tablet to easily show parents, tutors or carers what they are learning.

Easier access to learning materials from various locations

Schools can store electronic textbooks and other educational materials in dedicated online repositories, which children can access from anywhere using connected tablets, netbooks or e-readers. Pupils are able to easily find accurate information and explanations, regardless of their location.

Further benefits of making educational materials accessible from mobile devices include:

- A consistent learning experience: A pupil can access the same educational materials from everywhere.
- Reduced need for students to carry around heavy textbooks.
- Children can access e-books for personal reading and development during holidays.
- Many children will become more engaged with school work if they can use "cool" mobile devices.

- Where appropriate, the device can be used for fun as well as learning and this encourages feelings of ownership which increases willingness to use the device.
- Students can annotate learning materials without damaging physical copies.

Differentiated learning

Rather than handing out paper worksheets, which can easily get damaged or lost, teachers can send homework directly to their pupils' mobile devices. That makes it easier for teachers to set different tasks for different children, depending on their abilities. They can also send extended homework to children who fail to attend school on a particular day directly to their mobile device.

Further benefits of using mobile devices to set homework include:

- Easier to personalise homework materials and action plans for individual learners.
- Reduced requirement for printing and copying paper worksheets.
- Simple to update or amend homework, where necessary.
- Presentation of materials to suit the learner's needs/preferences – for example, the background and text colours can be adjusted for dyslexic students.

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Greater parental engagement

Delivering homework electronically to pupils' mobile devices opens up opportunities for schools to engage far more with parents and carers and, if necessary, to assist them with their own learning to improve their skills and employability. Also, parents can be copied in on emails setting homework, so they know exactly what is required of their child and by when.

Equipping pupils with mobile devices can also engage parents in other ways:

- Parents can use the information held on the mobile device to get a complete picture of their child's current curriculum and progress.
- Pupils can use their netbook or tablet computer to send absent parents their school work and ask questions, where necessary.
- Schools can use the mobile devices to send reminders about meetings, such as parent evenings.
- Parents' own skills can be improved in the process of trying to help children with homework and parents can also use the device for their own learning after the children have gone to bed.

Broader benefits

Connected mobile devices make it easier for pupils to complete homework and keep up with the curriculum even when their education takes place across multiple locations. Greater completion of homework should help students' attainment, improve schools' examination pass rates and enhance the education level of the future workforce. Improved student achievement, satisfaction, and feelings of being valued, trusted and supported by their school, can lead to less absenteeism, improved achievement, and a higher likelihood of progression into further and higher education, while making school leavers more attractive to employers.

Examples of how mobile devices are being used to support school children

Guiding maths students

Institution:
High schools in three U.S. States

Location:
North Carolina, Virginia, Ohio

Mobile devices used:
Smartphones

Qualcomm, a leading mobile technology company, began Project K-Nect during the 2007-2008 school year to determine if smartphones could play a role in enhancing student engagement and learning. The pilot programme was specifically designed to improve maths skills among weaker students in North Carolina who did not have access to the Internet at home.

In the first phase, 150 students in 8th-12th grade were given 3G-enabled smartphones they could use to access resources on algebra on the Internet both on and off school campus. The online content was aligned with current lesson plans and students were encouraged to learn from each other using social networking applications on the smartphone, as well as other Internet resources, such as algebra.com.

There was a positive correlation between students who actively participated in Project K-Nect and their final algebra I proficiency level on a standardised exam given by the State of North Carolina. Students at one of the participating Project K-Nect schools, increased their proficiency rates by 30 percent on the State of North Carolina's End of Course exam, compared to classes not in Project K-Nect, but taught by the same teacher. The project has since been extended into phases 2 and 3 and now supports approximately 4,500 additional students across North Carolina, Virginia and Ohio.

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Connecting low-income families

Institution:
English primary and secondary schools

Location:
Across England

Mobile devices used:
Laptop or netbook

In January 2010, the UK Government began awarding grants, which can be used to purchase computers and connectivity, to families with children aged 7 to 14 years who are eligible for free school meals. The vast majority of the 270,000 households that have participated in the Home Access programme chose to use the grant to purchase mobile connectivity.

Some 92% of the recipients chose to use the grant to purchase a laptop with a mobile broadband connection. A further 5.8% chose a desktop with a mobile broadband connection. The computers come pre-loaded with some learning tools and parental control software.

A survey of beneficiaries found that students are on average using the computer 10.1 hours per week at home, of which 4.7 hours are on learning-related activities. There was strong agreement amongst interviewed children that having the Home Access computer is making learning more interesting and is helping them to do better at school. There was also strong agreement amongst the surveyed children that their computer skills have improved significantly.

Pupils said they value the flexibility a home computer provides, by allowing them to do their homework or online research outside of school, rather than having to come into school early or stay late afterwards. Surveyed teachers noted the scheme has led to improvements in ICT skills and confidence amongst pupils.

There are also ancillary benefits. Most (57%) of the interviewed parents agreed that they are also more interested in using the internet than they were before they got the Home Access computer. This appears to have contributed to a high proportion of families continuing to pay for broadband access: Only 9% of households whose free internet period had finished said that they no longer have broadband connectivity.

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2.3 Out of classroom education and collaboration

Across a wide range of subjects, such as biology, history and geography, school and university students benefit greatly from field trips that enable them to get hands-on with a particular topic or see real-life examples for themselves. Mobile education solutions can make out-of-classroom learning even more valuable by enabling students to access contextual information in real-time and immediately upload measurements, photographs and notes into folders or a virtual learning environment on institutional servers or to where appropriate to online blogs or social networking sites. Students on field trips can also use mobile devices to collaborate with students and teachers in other locations.

Access to contextual information in the field

Students in outdoor geography lessons, for example, can use a smartphone or a tablet computer to access information about topography, sea level, rock formations and other contextual material on-site in real-time. GPS-enabled mobile devices can tag photographs with location data, can be used to locate sites to be studied and can provide data such as the longitude, the latitude and the altitude of areas of interest.

Biology students can use their mobile devices to take pictures of plants or animals and identify them by comparing their photographs to images online.

Augmented reality applications running on smartphones or tablets could show history students what a ruined castle, for example, looked like when it was first built. Language students can use similar applications to translate signs on trips abroad or they could use voice recognition software on their mobile devices to help them interview local people and then immediately check any words they did not understand.

The potential benefits of using mobile devices to access contextual information on field trips include:

- The real-time combination of observation and theory enables students to learn more than they otherwise would.
- It becomes easier for teachers to tailor contextual information to different learning styles and preferences and provide better support for learners with disabilities and/or learning difficulties.
- To further engage younger students, mobile devices can be used to find and unlock clues and information hidden in real locations using GPS-enabled devices.
- Mobile devices allow time in transit to be used for additional reading and study.
- Less need for paper and photocopying.

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Collecting and uploading data

Mobile devices can be used by students on field trips to record data or take notes and photographs, which can be immediately uploaded to a project or database online to be reviewed later. Students on scientific and environmental courses, in particular, can also use specialist mobile devices to collect and upload an array of data, such as the acidity of soil, the temperature of water or wind speed. University level students may even deploy mobile connected sensors that can monitor and upload data on the movements of wildlife or changes in temperature over time.

The potential benefits of using mobile devices on field trips to collect data include:

- More convenient and efficient note taking and data collection.
- Data captured by mobile devices is immediately stored online, where it can be reviewed by supervisors or other students.
- More time for learning back in the classroom as notes are already typed up.
- Students can fill in questionnaires in real-time, enabling teachers to monitor their degree of understanding.

Real-time collaboration across different locations

For economic or logistical reasons, only a subset of a class may be able to go on a field trip. If they are equipped with mobile devices, the trip participants can work with the other students back in the classroom, who can be asking them questions or giving them tasks to complete. Moreover, the group in the classroom can be working with the material uploaded by the group on the field trip.

Of course, mobile devices could also be used by students on field trips to coordinate activities between groups in different locations. For example, biology students could use their devices to compare the number of plant species in one field with the number in a different field and then use the data to determine where to look next.

The benefits of using mobile devices for real-time collaboration on field trips include:

- Even students that are not actually on a field trip can benefit from the exercise.
- Field trips across multiple locations can be easily coordinated.
- Students can ask remote teachers questions about what they are observing.
- Teachers can give students real-time feedback on the data they are collecting.

Broader benefits

The use of mobile devices to enhance field trips can make the experience more stimulating and rewarding for students, increasing their engagement in their education and improving their performance. In particular, mobile interactivity could encourage more students to take science-based courses, ultimately improving the innovation capacity of the economy as a whole. By enabling students to study while out of the classroom, mobile devices could also enable students to spend more time on field trips, increasing their practical experience and making them more valuable to future employers.

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How mobile devices are enhancing learning beyond the classroom

Enhancing field trips

Institution:
Chichester College Science and Technology, four secondary schools (Bishop Luffa College, Manhood Community College, St Anthony's School and Bourne Community College) and Highbury College

Location:
West Sussex, southern England

Mobile devices used:
HP iPAQs, Flip cameras, Etrex GPS trackers and other scientific mobile devices

In partnership with Natural England, employers and local schools, Chichester College Science and Technology's ran a project in 2009-2010 to explore how mobile technologies could support the development of 300 students on courses relating to land-based industries, such as farm management, conservation, horticulture, science and outdoor pursuits.

On a field trip to Kingley Vale, for example, one class from Bognor Community College used Garmin Etrex GPS trackers, easy GPS and Google Earth to build students' skill in understanding the accuracy of grid bearings and develop their knowledge of how grid references can be used to locate areas.

As a result, the students showed greater confidence when guiding other pupils in an unfamiliar environment, in comparison to previous occasions during field trips, according to their teachers.

Bourne Community School equipped its students on field trips with Flip cameras, data harvesters and HP iPAQs personal digital assistants, so they would be able to easily gather information to develop hypotheses and to form conclusions about other sites from their readings. Small groups worked together to collect and analyse data on the iPAQs. Other members of the class recorded field logs.

The school found the project enabled students to draw together several topics studied over the year and to develop individual investigative skills related to this knowledge. By applying the knowledge in the field they could observe real-time applications of science that they often compartmentalise as 'classroom' learning.

A dedicated learning space on Chichester Online ('Moodle') enabled partners to access and download learning content and, where appropriate, learners were able to upload completed assignments and complete other tasks via Chichester Online.

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Improving surveying techniques

Institution:
Capel Manor College

Location:
London

Mobile devices used:
A wide range of portable scientific equipment

Capel Manor College, a leading provider of land-based studies in London, used an array of mobile education solutions to support a project centred on students in its school of Arboriculture and Countryside. The project, launched in the 2008/09 academic year was designed to update surveying techniques from traditional pen and paper-based recording to more efficient and effective technologies.

The following technologies were used in the project: Weather stations, Digital sound Recorder, Digital Soil pH Meter, Binoculars, trail monitors (infrared beams) with cameras, Handheld GPS, Digital Dissolved Oxygen Meter, Digital Combo Meter, Water Quality Test Kit, Environmental Monitoring Test Kit, hypsometer (laser measuring device), Noise Meter and Acoustic Calibrator, Picus 12 (wood decay sensor), Digital light meter, Pettersson D-230 (bat detector), Sat-Nav systems, PDAs.

During the project, 155 students (86 full-time, 69 part-time) used the newly-acquired technology to various extents. Some students had a few sessions with specific pieces of equipment, other students had more exposure to a wider array of the equipment.

The college's report on the project noted that students embraced the technologies and engagement increased significantly during the initiative. Pupils also recognised that improved technology skills make them more employable. Exam results data showed that the students made significant improvements in achievement during the period.

It is becoming increasingly viable to connect scientific devices, such as those used by Capel Manor College, directly to mobile networks, enabling students to upload data directly from the instrument, ensuring accurate readings and saving time by having data transferred immediately to the application where it will be analysed.

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2.4 Professional learning and development

Many people in employment are also studying for, professional qualifications, for example MBAs or doctorates, or learning foreign languages. They may be either supported by their employers or pursuing their studies independently. These part-time students can find it difficult to carve out enough time for the necessary reading and to complete course work. Connected smartphones, tablets, netbooks and laptops can help by enabling employees to study while commuting on public transport or during breaks at work. Convenient and flexible, mobile education solutions potentially enable employees to access online materials, interact with other students or draft coursework no matter where they are.

Remote access to learning materials

Employees studying alongside work can use a mobile device during their lunch hour, or while in transit, to read textbooks as and when they need to. Stored in an online repository, a complete library of course material can be available at the student's fingertips via a mobile device at any given time. Students can also use tablets, netbooks and laptops, in particular, to write essays, complete assessments or other coursework in spare moments, send their work to their tutors and receive feedback.

Benefits of using mobile devices to provide remote access to learning content include:

- Time-poor students have much greater flexibility about when they study.
- Ability to access specific reference materials at any time without having to carry heavy textbooks to and from the workplace.
- More efficient and effective delivery of mandatory workplace training to employees at any time in any location.
- Ability for students to watch live lectures and participate in webinars when in-person classroom attendance is not possible.

- A greater proportion of class time can be spent on discussions, enabling tutors to give more in-depth explanations of difficult concepts, rather than just imparting basic information.
- Easier to personalise learning materials for individual students.

Interacting with other students

Part-time students can use mobile devices to easily contact their fellow students, swap notes, ask questions and exchange advice. People on professional development courses can also use smartphones, tablets and connected computers to work together on collaborative projects, swapping documents, photographs, videos and other relevant content at convenient times, rather than waiting until they are at home or work.

Broader benefits

More broadly, equipping students with mobile devices can make professional learning and development more enjoyable, efficient and effective, leading to better-qualified and more-capable employees. The flexibility offered by mobile devices should also enable employees to complete courses quicker, enabling tutors to make more efficient use of training rooms and training staff and reducing workplace disruption. By making it easier to combine studying with work, the use of mobile devices could also encourage more people to engage in lifelong learning, updating skills or re-training as appropriate. Ultimately, a better-educated workforce should be more competitive, boosting individual companies and the economy as a whole.

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How mobile devices are supporting professional learning and development

Learning in transit

Institution:
Investment bank Merrill Lynch

Location:
Worldwide

Mobile devices used:
BlackBerry smartphones

Investment bank Merrill Lynch has a highly mobile, global workforce, with employees often struggling to find time for learning and development activities, especially classroom-based learning.

To help its employees study, in 2007, Merrill Lynch began a seven-week pilot programme in which educational content was wirelessly pushed out to 2,100 employees' BlackBerry smartphones, enabling them to access learning materials on the daily commute or while travelling on business. The content consisted of three mandated compliance courses, accessible via both the smartphones and laptop and desktop computers.

The trial participants completed their compliance training 20 days ahead of the deadline and the pilot group were estimated to have gained 4,270 hours of extra productivity - about 4-6 hours per participant. In addition, the pilot participants achieved higher scores in the compliance training than other Merrill Lynch employees.

The success of the pilot prompted Merrill Lynch to begin developing an additional 14 mobile courses and roll out a dedicated mobile learning product, called BlackBerry GoLearn, to 22,000 employees.

Helping physician trainees to continue learning on placements in hospitals and remote clinics

Institution:
University of Botswana School of Medicine

Location:
Botswana

Mobile devices used:
Android Smartphones

Specialist physician trainees (residents) spend time working in referral hospitals in cities and in district hospitals and clinics in remote areas. However, at city hospitals Internet access can be unreliable with low bandwidth and computer resources are not very good. In remote areas, gaining access is more challenging and specialist mentors are not readily available on-site.

Residents in Medicine and Paediatrics specialty training programs, based at a referral hospital in Gaborone, were provided with Google myTouch smartphones, equipped with Android-based medical information applications, built-in camera, and data-enabled SIM card. Point-of-care applications loaded locally on the phones included Dynamed, Archimedes, ePocrates Rx, and 5-Minute Clinical Consult, in addition to email, web access, and a telemedicine application that allows for the submission of cases to local mentors.

Study coordinators conducted an initial training session. Residents were encouraged to use these phones as much as possible, in and out of the medical setting, over an eight-week period. Participating residents were surveyed at four and eight weeks following the distribution of the phones to assess the ease and frequency of use.

For trainee physicians access to information technology resources, particularly medical information, at all clinical training sites is crucial. The growth of mobile networks and mobile devices is enabling trainees to circumvent the challenges of poor connectivity and is fostering the growth of mobile education resources for healthcare providers.

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2.5 Literacy skills

Some children can be reluctant to read full-length books either because they find them intimidating or because they may be embarrassed to be seen carrying books that suggest their literacy skills are not as good as those of their peers. This is even more true for adults with poor literacy skills. Delivering books electronically in phases, divided into individual episodes, can make these texts more accessible, encouraging reading and improving literacy skills. Moreover, e-books are hidden inside tablets or other mobile devices, making it more difficult for others to see that someone is reading and what is being read. E-books can also easily be annotated or shared with other readers, enabling enjoyment of a more interactive reading experience.

Increasing accessibility

Delivering a book electronically to a mobile device enables it to be personalised in line with the needs and preferences of the learner. If weaker readers feel challenged by large volumes of text or have a short attention span, a book can be delivered to a tablet computer or smartphone, for example, in manageable chunks or broken up by illustrations. Moreover, a mobile device can be configured to read parts of the text aloud to help with more difficult passages. Delivering reading books electronically also has other advantages:

- A large selection of reading books is always available, making it easier to find an appealing story or text.
- Built-in dictionaries enable learners to call up definitions of words they do not understand.
- Mobile devices can be used to call up images of real places or objects referenced in a book they are reading.

Removing stigma

Traditional books are not considered 'cool' by some students, such as teenage boys, so delivering books discreetly to mobile devices can help remove this stigma and increase enjoyment and engagement. At the same time, electronic books are less visible to others, reducing the likelihood of teasing or bullying of children or young people reading relatively simple texts with lots of images.

Interacting with texts

Readers can annotate their electronic copy of a book or they can use a mobile device, such as a tablet or netbook, to write their own story responding to the text they have just read. Alternatively, they can use the mobile device to co-write stories with others, with each writing a section. Collaborative writing can be a fun way for learners to demonstrate their creativity, enhancing their self-esteem and self-confidence. It also adds elements of competition and play which encourage more reading and writing.

People can also interact with electronic books in other ways:

- They can record themselves reading the book, enabling specialist apps to compare their pronunciation with recorded texts and help correction of any mistakes.
- At the end of each chapter, an electronic book can ask questions to check understanding.
- Electronic books can include games and puzzles designed to further engage young readers.
- Learners can use a mobile device to ask teachers questions about an electronic book, highlighting the passage they want to discuss.

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Broader benefits

Electronic books delivered to mobile devices can make reading a richer and more engaging experience, helping learners to become more literate and knowledgeable. Better literacy skills and greater knowledge should translate into higher levels of academic and workplace achievement and ultimately a more educated workforce, benefitting both individual employers and the economy as a whole.

How mobile devices are encouraging children to read

Episodic reading in schools

Institution:
UK Schools, Wolverhampton Learning2Go Project and publisher Rising Stars

Location:
U.K.

Mobile devices used:
Smartphones, netbooks, laptops

Since January 2009, education publisher Rising Stars has been running a service for schools called "The Extraordinary Files e-book reading experience" which is designed to engage reluctant learners (especially those with lower ability) by delivering one chapter of a book at a time to interactive whiteboards, smartphones, netbooks or laptops, supplemented by comprehension questions and creative writing exercises.

After downloading the first episode from the learning platform, the children (aged 9-12) have to email the answers to questions relating to the text to the e-books email account in order to unlock the next episode. This process continues up to episode 4, which the children then have to write themselves. Rising Stars staff and the original author judge the "entries" and choose a winning episode which is then published as an "Official" episode in the series with the young author acknowledged as an iStar.

Anecdotal evidence shows that the programme has produced resoundingly positive results and has won over teachers and learners alike. In the future, the potential for "City wide" learning which can be delivered via the mobile device in conjunction with a learning platform will be explored more widely with the introduction of the Wolverhampton Reading Cloud.

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Interacting with novels on mobile handsets

Institution:
The University of Cape Town, funded by the Shuttleworth Foundation and with technical support from Fontera and Clockwork Zoo

Location:
Throughout South Africa

Mobile devices used:
Mobile phones

The University of Cape Town set up the Yoza Project, originally known as m4Lit (mobile phones for literacy), to explore the viability of using mobile phones to support reading and writing by young people in South Africa. Beginning in September 2009, the pilot phase of the project involved publishing a story, called Kontax, in episodes on a mobisite (an adapted web site) and on social network MXit in English and in isiXhosa. Within a month, Kontax attracted 63,000 subscribers who were invited to interact with the story as it unfolded – teens could discuss the evolving plot, vote in polls, leave comments, and finally submit a written piece as part of a competition for story sequel ideas.

Following the success of the pilot phase, a bigger project, called Yoza, was launched in August 2010. A year later, Yoza contained 28 novels, 5 Shakespeare plays and 11 poems. Genres include teen issues, romance, soccer, adventure and "classics" such as Shakespeare, poetry. Some stories are serialised (a chapter a day) and every chapter of every story has a comment prompt or vote prompt. The stories are produced in English, Afrikaans and isiXhosa. In the first year, complete reads of the stories and poems reached 300,000.

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2.6 Supporting students with learning difficulties and disabilities

There are many ways in which mobile education solutions can help people with learning difficulties or disabilities and older people whose sight, hearing or dexterity is not as good as it once was. Applications on smartphones, tablets, netbooks or laptops can deliver educational content in ways that match the needs of the learner, including using large text, audio, images or video. More broadly, the support provided by mobile devices can give people with learning difficulties and disabilities greater confidence and self-esteem.

Making learning more accessible

Highly-portable mobile devices, such as smartphones, handheld media players, tablets and netbooks, can accompany students wherever they go, providing reminders and 'how-to' tutorials as and when they are needed. They can also be used to convert text into speech or vice-versa and deliver educational content through videos with sign language for deaf people or as audio podcasts or audio books for blind or partially sighted people. Other ways in which mobile devices can help people with disabilities or learning difficulties in education include:

- People who cannot write with a pen can use the touchscreen of a tablet computer to select words or images.
- Smartphones and tablets' touchscreens can be more intuitive than a computer mouse for people with learning difficulties and they can be easier to use for people with reduced hand dexterity.
- Text size, text and background colour and screen contrast and brightness can be adjusted to suit the individual needs of partially sighted and dyslexic students.
- If they prefer, learners can use voice commands to interact with some mobile devices.

Increasing confidence and communication

Mobile devices can enhance the communication skills of people who find it difficult to talk to other people, by enabling them to send and receive text and picture messages. Teachers may find some students are more receptive to guidance provided remotely in written form, rather than delivered verbally face-to-face. At the same time, growing competence with a mobile device can also raise the self-esteem of people with learning difficulties and help them develop valuable life and work skills.

Broader benefits

By offering people with disabilities or learning difficulties the opportunity to learn in a way that suits them, mobile educational solutions can help more disabled students attain qualifications and become more attractive to employers. Mobile education could thereby improve the employment prospects for people with disabilities, enhancing their independence and creating a larger pool of skilled workers for employers to draw upon.

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How mobile devices are being used to support students with learning difficulties and disabilities

Using tablets in special schools

Institution:
Special schools

Location:
Texas, U.S. and Queensland, Australia

Mobile devices used:
Apple iPads

In July 2011, Kuraby Special School in Australia ordered 20 iPad tablet computers to help it teach children with disabilities. Teachers say students who are unable to communicate verbally can use the iPad to speak on their behalf, while those who can't write with a pen are able to use the touchscreen.

In the same month, the Jane Justin School in Fort Worth in the US ordered two dozen iPads to help educate children with special needs, after parents found that the devices had enabled their autistic children make big improvements in class. The Jane Justin School received a charitable foundation grant to buy the iPads.

Improving parents' signing skills

Institution:
Longwill Primary School for the Deaf

Location:
Birmingham, England

Mobile devices used:
Sony PSP

Teachers at Longwill Primary School for the Deaf in Birmingham have developed an innovative solution to support the important parent and child bonding process of reading bedtime stories.

Nine out of 10 deaf children have hearing parents who often take much longer than their children to develop signing skills. This can result in communication problems between parents and their deaf children, particularly in the early years and with more complex conversations.

Teachers at Longwill film videos of sign language readings of story books. Parents wishing to improve their signing skills can then access these videos by reading a link embedded in semacode (similar to a barcode) on stickers attached to the book pages using the camera on a Sony PSP mobile games device and Second Sight software. Pupils are able to borrow these books from the school library along with a school PSP.

The PSP currently accesses the videos via a Wi-Fi connection. However, 3G versions of the PlayStation Vita are scheduled to become available during 2012, potentially enabling parents and their children to view the videos wherever they are.

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3. What can the mobile ecosystem bring to education?

3.1 Mobile networks based on the GSM family of technologies are reliable and pervasive

The GSM family of technologies has been providing people with mobile communications services since 1991 and GSM is now used in 219 countries and territories by more than four billion people. The GSM family of technologies also provides travellers with access to mobile services wherever they go – approximately 90% of the world's population are covered by GSM networks.

In more than 30 years of development, GSM has been continually enhanced to provide platforms that deliver an increasingly broad range of mobile services. Whereas the industry started by offering plain voice calls, it now has a powerful platform capable of supporting mobile broadband and multimedia services. Mobile operators continue to invest heavily in their networks to build capacity to facilitate these new content-rich services.

Connecting construction sites in Sweden

Many companies in the private sector now rely on mobile networks to provide broadband connectivity to nomadic employees. For example, Skanska, a Swedish construction company, uses mobile broadband services to give employees access to core business applications while on a construction site or travelling.

By June 2008, Skanska had equipped 1,620 employees with mobile-enabled (HSPA) laptops connected to 3 Sweden's network, meaning they no longer had to wait for weeks for a fixed-line connection to be installed in a new building site.

Skanska says employees are now able to carry out all work-related activities in any location, increasing their productivity. Having instant access to complete and up-to-date information on a project has enabled fast and accurate decision making, and Skanska's service to customers has improved as a result. Education institutions can also benefit from the flexibility and coverage offered by mobile broadband networks.

Mobile networks are secure

On turning on their mobile phone, consumers can be assured that the network will recognise them and then route calls made to their phone number correctly. An inherently high level of security enables mobile networks and devices to be utilised for sensitive transactions such as mobile payments and legally-binding mobile signatures.

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Mobile payments

All four French mobile operators (Orange-France, SFR, Bouygues Telecom and NRJ Mobile) have launched a service in the city of Nice which enables consumers to use their handsets to redeem coupons, collect loyalty points and pay for goods, services and transport tickets. Nice citizens can now pay for goods and services by swiping their mobile phones in front of readers in shops, input their PIN and then have money debited from their account. The identity information required to enable the payments is stored on the SIM card.

The service is designed to be convenient for consumers who may not always have cash on them, as well as opening up interactive marketing opportunities for merchants. The success of the Nice service, which was launched in 2010, has prompted the French mobile operators to begin rolling out the same services to other French cities.

The Nice contactless services utilise the security elements inherent in a mobile device's SIM card. It is also based on partnerships between the operators, banks, merchants, the local government authorities and other key organisations in the Nice area.

This example highlights how mobile devices are increasingly being utilised for services that require high levels of security.

Mobile signatures

On the Internet it is easy for people to assume false identities, creating challenges for consumers and companies looking to conduct transactions online. For electronic commerce to achieve its full potential, people need to be certain of the identity of the entity they are interacting with.

Mobile signatures require an individual to type a secret PIN code into their mobile phone, which is then used to generate a cryptographic algorithm that acts as a digital signature that can be authenticated by their bank or a trusted third party. In this way, mobile signatures can be used to identify and authenticate people online, enabling them to sign secure transactions, seal secure documents or facilitate any other actions that require authorisation from a specific individual.

Turkcell's Mobile Signature service, for example, creates the same legal result as a handwritten signature, according to the Turkish Digital Signature Law.

In the field of education, teachers could use mobile signatures to confirm their identity when uploading students' test results or other sensitive data, while students could use a mobile signature to log in to an online teaching module, authenticating themselves so that progress through online assignments is accurately tracked for each individual.

Mobile networks can be combined with other types of connectivity

Many mobile devices are now also equipped with Wi-Fi connectivity, as well as cellular connectivity, enabling consumers to use the best (and/or cheapest) connection available to them at any given time. Students and teachers can make use of Wi-Fi networks within education institutions, and enjoy seamless connectivity when they leave the building via a mobile broadband network. Combining Wi-Fi and mobile broadband can help educational institutions manage connectivity costs, while ensuring that learners and educators can easily access their materials when they are out of the classroom.

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3.2 The mobile industry brings relevant expertise to the education sector

There are a number of skills that the mobile ecosystem (mobile operators, handset manufacturers, systems and solutions providers) could bring to enhance the delivery of mobile education solutions.

These include:

- Experience of building scalable and interoperable information and communications systems.
- End-to-end systems development and management expertise, from user experience and device configuration through to network and database management.
- Systems support and troubleshooting expertise.
- Customer relationship management and billing systems.
- Security and user authentication.

In addition, many companies in the mobile ecosystem enjoy strong brand recognition and trust among students and learners.

Mobile operators' customer care and technical support capabilities

Operators have a pre-existing requirement to support their customers and their expertise in this area could add considerable value to the education sector. Mobile operators often provide large corporate clients with dedicated customer support teams, and can provide a similarly tailored customer support service to education institutions and their students.

Device management, content management and cloud services

Mobile operators' expertise in deploying and managing vast numbers of devices, on behalf of business customers, can also be of benefit to institutions deploying mobile education solutions. Mobile operators have considerable experience in managing device requirements, sourcing and configuration; device rental and insurance schemes; device configuration or content updates and support; and two-way asset monitoring and control.

As the number of different devices and content formats grows, mobile operators have become experienced in delivering and maintaining content in different formats suitable for various device types. Operators' expertise in this area could be useful to educational institutions who want to be sure that their learning materials are compatible with all their students' device types and are future-proof as well, so that last year's learning material can be accessed on new devices.

Mobile operators may also provide cloud services, such as managing the databases that store learning materials and textbooks, administration and student records, e-Portfolios and digital lockers, which students can access from a wide range of devices. If cost-effective deals can be negotiated and education institutions have confidence that appropriate, secure and reliable services can be provided, they may use these services to supplement or reduce the overhead of running their own large in-house systems.

Building partnerships to deliver end-to-end services

Most mobile operators have considerable experience of partnering with other organisations, including content providers, application developers and vertical industry partners in different industries, to provide end-to-end services. They can use these skills in the education sector to build end-to-end services on behalf of institutions that want to only liaise with one partner, rather than with several suppliers, to design and run their electronic and mobile education services.

Such end-to-end services could incorporate unified billing for content, applications and connectivity. This kind of consolidation greatly reduces the project management and administrative burden for the education provider.

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CSL – serving senior citizens

In 2008, Hong Kong-based mobile operator CSL partnered with the Senior Citizen Home Safety Association (SCHSA) to develop and launch the Mobile Link service, which provides 24-hour support and monitoring for senior citizens who wish to maintain an active lifestyle. Mobile Link tracks the senior citizen's location and provides immediate assistance, if required.

The service has three key components:

1. **A customised Mobile Link application platform with mobile positioning functions.**
2. **Integration of the Mobile Link application platform with the SCHSA call centre and CRM system.**
3. **A simple-to-use mobile device with a panic button and emergency pull-pin, especially designed for elderly or disabled users.**

Following the success of the Mobile Link service, CSL and the SCHSA worked together to launch the Safety Phone - a Swiss-made mobile phone for the elderly with support for hearing aids.

The Mobile Link service is a good example of how mobile operators have partnered with adjacent industries to provide innovative new services and tailored devices and solutions.

3.3 Safe use of ICT by children

The Internet can now be accessed on many mobile devices opening up a world of opportunities for communication, interaction, entertainment and learning, but also certain risks for children. These risks include access to both illegal and legal, but potentially harmful, or inappropriate, content. Many mobile operators have taken active steps to reduce the risk of children being exposed to this content. For example, in the UK, mobile operators provide Internet filtering which blocks access to material deemed inappropriate for children. Being registered as a child user means you cannot access material provided by your mobile operator, or its partners, that has been rated only appropriate for people over 18. All mobile phone users are considered to be children by their UK mobile operator unless or until they have proved to their mobile operator that they are 18.

Recognising the need to safeguard mobile networks from being misused to access illegal child sexual abuse content, the GSMA has created the Mobile Alliance Against Child Sexual Abuse Content. The Alliance aims to stem and reverse the growth of online child sexual abuse content around the world. Over 100 mobile operators are part of this voluntary group. Through a combination of technical measures, co-operation and information sharing, these operators are creating barriers to the misuse of mobile networks for hosting, accessing or profiting from illegal content.

Teachtoday.eu

TeachToday.eu is a partnership between internet and mobile industry leaders and EUN Schoolnet. The GSMA and several of its operator members (Orange FT Group, Telefonica, Telecom Italia, Vodafone and Deutsche Telekom) are on the Central Steering Committee for Teachtoday.eu.

Teachtoday provides information and advice for teachers, head teachers, governors and other members of the school workforce about the positive, responsible and safe use of new technologies. The types of information provided includes:

- **Teacher advice** offers guidance about how to protect teachers' privacy, safety and reputation online, maintain professional boundaries and deal with incidents of cyberbullying against school staff.
- **Student advice** offers advice about how to promote the positive, safe and responsible use of new technologies to students.
- **Impact on schools** summarises what action schools can take in terms of developing policies and programmes related to new technologies.
- **Technology today** provides an overview of some of the new technologies teachers or students might come across.
- **Case studies** gives examples of cyberbullying incidents against teachers and other misuse of new technologies and provides advice about what action to take if something similar happens.

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The GSMA's Mobile Education initiative aims to accelerate the adoption of mobile education solutions; in particular, the use of portable devices with mobile connectivity, such as smartphones, e-Readers and tablets, in mainstream education settings.

We believe that globally-coordinated activity, drawing on the sharing of experiences and best practices, will be vital to understanding and acting upon the mobile education opportunity. We encourage you to get involved, whichever part of the ecosystem you belong to, please contact mobileeducation@gsm.org to learn how.

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