

# The use of Mobile Technologies to support Personalised Learning

Michael Wilkinson  
i-ed.info

Introduction .....	2
Context and Background .....	3
What are mobile technologies? .....	3
What is mobile learning? .....	3
Pedagogical Rationale.....	4
Aims of the Project .....	6
The Case Study .....	7
The pilot group .....	7
The Technology.....	7
Innovation and Implementation .....	9
Research .....	9
Development .....	9
Vertical Integration .....	11
Horizontal Integration .....	11
Dissemination .....	12
Evaluation .....	13
Data Collection .....	13
Teacher Researchers .....	13
Pupil Researchers.....	13
Active Researcher.....	13
Pupil Questionnaires.....	14
Concept Mapping .....	14
Interviews.....	14
Findings and Discussion.....	15
Personalised Learning.....	15
Wider discussions of m-learning.....	18
Motivation, engagement and self esteem.....	18
Literacy .....	19
Ubiquitous Computing.....	20
Conclusion .....	22
Bibliography.....	23

## **Introduction**

We are living through a time of profound change in the landscape of digital technology and the way it interacts with our everyday lives. New technologies are changing the way that different aspects of society interrelate from national government policy to localised service provision. Education is one of those services which is changing and being changed as a direct result of technological innovation. This case study critically evaluates one such example, focusing upon the use of mobile technologies to support the personalisation of learning as per the governments 'Every Child Matters,' and 'Personalised Learning' agendas.

This paper commences with a discussion of mobile technologies and their affordances to learning, introduces the pedagogical rationale for personalised learning with discussion of how mobile technologies and m-learning can enable this paradigm shift. The paper then introduces the pilot project as a case study discussing the aims of the project, the key parties involved, the implementation as an innovation, before presenting the evaluation methods and findings together with the conclusion.

## Context and Background

### What are mobile technologies?

Mobile technologies (or mobile device's) can be classified into three general classes of product, handheld computers (PDA's), mobile phones and personal media players (media referring to music, video etc.). Technological innovation has led to the convergence of numerous of these technologies into a single device i.e. a handheld computer (running a Windows based operating system), a camera, a video camera, TV, a mobile phone (including voice and data), GPS, media player, radio, internet access (GPRS) , email etc. These hybrid devices, most often referred to as a Personal Digital Assistant (PDA). For the purpose of this paper, the terms mobile device and mobile technology will allude to the PDA.

### What is mobile learning?

In its broadest sense, mobile learning or m-learning simply refers to 24/7 access to learning through the use of a mobile ICT device. Wood (2003) provides a definition:

*"The term mobile learning (m-learning) refers to the use of mobile and handheld IT devices, such as PDAs, mobile phones...in teaching and learning."* (Wood, 2003)

This contrasts with the viewpoint of O'Malley et al. (2005) whom suggest mobile learning only alludes to that learning which occurs outside the usual environment (school). This neglects learning, both formal and informal occurring within the school environment.

For the parameters of this study; m-learning will refer to 24/7 access to learning; incorporating both formal and informal learning, inside and outside the school gates (anywhere) via a mediating tool; a mobile device (i.e. a PDA).

*"Learning is but an adjunct to ourself  
And where we are our learning likewise is"*  
(Shakespeare, 1595)

## **Pedagogical Rationale**

The strategic demands of our educational environment are changing, reflecting our ever changing society. Implementation of a personalised learning culture reflects the challenges of personalisation as per government policy. Recent trends towards 'anytime, anywhere' learning mirror the changes from a manufacturing base to a knowledge base economy where the knowledge and skills of citizens are becoming increasingly important both for the economical strength and social cohesion of our society, and the quality of citizens' life. (Sampson & Karagiannidis, 2002). In addition, the challenge for educators is not simply to increase skills and knowledge base of learners, but to ensure those skills are flexible, transferable and derive learning from the knowledge base, skills and experiences of each and every learner, or as Rosenberg (2002) describes, 'personalised training schemes tailored to the learner's objectives, background, style and needs.' Personalised learning assumes every student enters the classroom with a different knowledge base and skill set, together with various attitudes, aptitudes and aspirations.

Conventional pedagogical practices within schools have mainly focused upon the delivery and dissemination of academic content (transmission pedagogy, assuming all learners have similar aptitudes, attitudes and aspirations; a cognitive learning method described as 'meaningless' by Rogers (1969). Rogers suggests an alternative 'significant' method (experiential learning), involving the process as a means of learning and knowledge construction, rooting learning within the different skills and knowledge base from each learner. Jonassen et al (1999) explain it is the process not the product which is central to a learner's ability to construct knowledge. Kolb (1984) further explains the learning process as being supported by people (thus dialogue) and is based upon experience (Houle, 1980). This gives rise to dialect and conversation within classroom praxis in order that learners can construct and reconstruct knowledge as a result of cognitive conflict; following appreciation of other learners' viewpoints (Scardamalia & Bereiter, 1994; Baker, 1994; Dillenborough & Schneider, 1995; Veerman, 2000). Knowles (1998) proclaims that a key feature of education is the experience each learner brings to the environment. Personalisation within classroom learning focus' upon experience and centers learning around learners themselves, giving ownership of their own learning; learning through numerous locations (space) and time, in school, at home, whilst traveling and socializing etc. The key question is how we build this offer for every learner.

ICT makes the personalised learning agenda achievable, manageable, and sustainable – in short, deliverable (Becta, 2005). Internet ready PC's have traditionally been seen as the major delivery

vehicle, but with only 53% of UK households (Directgov, 2006) having access to the internet, and (even when a school meets all ICT requirements defined by Ofsted) only 15% of a learners school time provides access to ICT, (Microsoft, 2005) we must strive to harness new technologies to increase access to ICT, lessen the digital divide, widen participation and enhance home-school links. Mobile technologies provide this very opportunity. Moseley and Higgins (1999) suggest mobile devices do not dominate classrooms in the same way as desktop computers, thus can be integrated much more readily; increasing access to ICT within schools. Furthermore, Perry (2002) proclaims the integration of mobile technologies prevents the necessity for purpose built ICT suites and thus mobile devices can be used across the curriculum with ease. In addition, the ambition of one device per learner can be achieved at reduced cost through mobile devices, without providing 'static barriers' of PC's in classrooms. Passey (1999) extends this research focusing upon the portability of mobile devices and how this enables students to take work home and foster feelings of greater ownership of work. Such portability affords better home-school links and helps lessen the digital divide (Perry, 2003; Merchant and Monteith, 1997). Exploiting the hybrid functionality of the mobile device enables not only independent learning but also collaboration and dialogue anytime, anywhere and provides always on access to learning, enabling learners to focus on whatever learning they desire, whenever the desire and an opportunity to collaborate with peers through a wide variety of methods; rooting learning with each learners individual experience and unique skills sets.

In summary, mobile devices can truly support learning 24/7, owing to their portability and converged functionality, and could by nature become ambient devices within the life of a learner, with every potential to integrate as a learning tool almost as effortlessly as pencil and paper; *this is mobile learning*. It is upon this notion the research within this project will be conducted.

The rationale stated above suggests a clear requirement for the personalisation of learning and the use of mobile technologies as an appropriate vehicle to deliver this.

## **Aims of the Project**

Having identified the rationale for the personalisation of learning, this study primarily aims to critically evaluate the use of mobile technologies to support personalised learning along the following dimensions:

1. Identify the particular benefits which transpire as a result of adopting m-learning to support the personalised learning agenda
2. Identify and evaluate the wider benefits of m-learning to teaching and learning including raising standards and attainment
3. Investigate the ways in which these benefits can enhance not only the personalised learning agenda but also impact upon other educational initiatives
4. Investigate the social implications of m-learning
5. Consider whether the benefits of adopting m-learning are congruent with the notions of ubiquitous computing
6. Identify and appraise the issues surrounding the adoption of m-learning
7. Consider any further potential benefits of using mobile technologies which may accrue in the near future as the technology develops.

The above specifically focus upon learning processes; however the study has the following secondary aims in order provide a model for sustainability of mobile technologies to support learning:

8. To trial the use of a personalised 'student owned' device in secondary schools
9. To integrate mobile technologies into mainstream curriculum education

## **The Case Study**

The pilot project was launched in September 2006, to deliver the OCR Nationals ICT qualification to Key Stage 4 students, providing mobile devices in support of the study. The timescale was defined as an academic half term, chosen because this is the shortest natural timeframe within the academic year and owing to the small size of the pilot group.

The development section of implementation discusses the case study in more detail.

### **The Pilot group**

*Please Note: School name and town have been omitted for privacy reasons.*

X School (Secondary) is situated in a deprived region of Y, highlighted by Ofsted as being in 'notice to improve' (danger of special measures). Located on the schools grounds is a City Learning Centre which indicates the low attainment and need for improvement within the host school. The school has however enjoyed much success in embedding ICT into the curriculum with a strong commitment from both senior leadership and teaching staff to enhance current provision.

Twenty four students were selected to participate in this program. The cohort of 5 girls and 19 boys, were identified as hard to reach individuals, currently attaining sub grade D at Key Stage 4. There were individuals within the cohort who had been identified as having behavioral problems. The ICT course aimed to provide the students with a qualification equivalent to four GCSE's, grade C and above.

Four members of teaching staff were also the focus of study, two ICT teachers directly involved within the focus ICT course, one Mathematics teacher and one English teacher. These members of staff were chosen as they were in the most direct contact with the majority of students (owing to set placement of the cohort) and therefore the project could maximize of data collation.

### **The Technology**

The learners within the pilot group and the associated teaching staff were supplied with the O<sub>2</sub> XDA IIs (mobile phone with PDA functionality). An extensive review of available mobile technologies had been conducted by the Learning and Skills Development Agency within their 'm-learning project' who suggest with regards the O<sub>2</sub> XDA IIs:

*"The learner's visual and audio experience...is similar to accessing web-based materials via a PC..." (Attewell, 2005)*

Functionality of the device includes, keyboard, hand writing recognition, still and video camera, music player, voice memo recording, email, internet, WiFi, organiser functions, Microsoft Windows Operating System, Microsoft Office Software, support for Adobe (Macromedia) Flash 6, instant on (no wait for boot up) and all in a small size, low cost, portable device.

The primary means of connectivity was through wireless access provided both in school and throughout the CLC. 24% of the participants also had internet access at home. As 100% of the pilot group owned a mobile phone, GPRS access could also be achieved by using existing SIM cards in the XDA mobile devices.

Teaching and learning processes evolved around a managed learning platform for mobile devices, 'RedHalo'; supporting content creation and distribution through wireless connections.

## **Innovation and Implementation**

This project combines two innovations for the educational system; one policy driven (personalised approach to learning) and one technological (use of mobile technologies to support learning). The aims defined for the project are to appraise the use of mobile technologies in support of the policy, thus the focus of implementation is the use of those mobile technologies.

As the implementation centralizes around the integration of an educational innovation the 'Research, Development and Dissemination (RDD) model' was consulted, involving the following stages:

- Research by experts to create the innovation
- Development with a small pilot group (i.e. this specific project),
- (Eventual) outcome being the dissemination of the innovation to the whole system (school, authority and practice shared with a wider educational network).

### **Research**

Research had been conducted and defined through government agendas and policy which indicated the requirement for personalisation, hence the policy driven objective of this project is to personalise learning. The project also draws on the research, experience and success of other projects such as the Bradford 'Learning Everywhere,' Wolverhampton 'Learning to Go' and Bristol 'Hand e-learning' all of which helped inform the approach to implementation through consultation.

### **Development**

The focus of this project is the development stage of the RDD model, implementing the innovation (use of mobile technologies) through a pilot i.e. with a small pilot group.

The pilot involved providing all members of the pilot group 1:1 ownership of a mobile device (O2 XDA IIs) as the delivery vehicle for m-learning in support of all the projects objectives as defined earlier. In order to trial the notion of providing students with such devices (objective 8) a parent contribution model was adopted. This involved parents making a financial contribution to cover the costs of insurance and to delegate some level of responsibility to the parent, provide a central means to provide parental access to curriculum and mark books (in support of objective 1) and to improve home school links, widen participation and lessen the digital divide (nationally 2.5 million school age children do not have access at home – 30% of children at school and in our local communities this is up to 70% of children without

access to ICT). In the pilot group 47% of the learners did not have access to the internet outside of school. By providing an internet ready ICT device in the home (in support of objective 3) all learners had 24/7 access to ICT. It was deemed essential that students have complete ownership of the device in order that they take ownership and responsibility for the device and their own learning; are were able to use the device for multiple purposes including leisure and social grounds (in support of objective 4), have maximum exposure to the devices to uncover any associated issues surrounding mobile learning (in support of objective 6 and 7), discover benefits for personalised learning (in support of objective 1) and wider benefits to learning par se (supporting objective 2). This would also allow learners to use the devices across the curriculum (in support of objective 9); with the senior leadership directorate which provided the authority to use the devices across the school. Teaching staff would make personal judgments or follow learner request to disseminate appropriate content, or scaffold knowledge through mobile interactions to support personalisation (objective 1). Software and resources were loaded onto the devices in order that learners had multiple means of representing their knowledge such as concept mapping software, notepads, audio recorders, text transcribers, word processors etc. Lessons were delivered to students incorporating motivating, challenging and meaningful tasks, enabling the students to make the choice of whether or not to utilise the mobile device for the purpose of the task. Lesson content and additional resources including teacher presentations (generally PowerPoint) were synchronized or beamed to the student's devices at the end of each lesson.

The devices were therefore supplied as delivery vehicles for learning and the learners empowered by technology. The pilot would seek to find out whether this technology was accepted, opportunities to learn increased, and through such acceptance, attainment and motivation to learn increased.

Becta (2006) suggest the following key aspects with regards ICT to support the agenda:

- Supporting anytime, anywhere learning
- Continuity of learning and out-of-hours learning
- Tailoring content to user needs and learning styles
- Enabling peer/mentor dialogue
- Assessment for learning
- Involving learners in their own learning

Implementation focused upon each strand suggested above which would then be evaluated to assess the impact of the project. Both horizontal and vertical integration methods were employed affording the benefit of wider usage of m-learning and increased opportunities

for the students to recognize the capabilities and advantages of m-learning and therefore increase the opportunities to learn.

### **Vertical Integration**

Supporting the notions of personalised learning, a broader and more personal curriculum was offered to the cohort in the form of the vocational OCR Nationals ICT; accounting for 4 GCSE qualifications. Ownership of the mobile devices was provided in direct support of the ICT qualification, notably the 'New Technologies' module, providing the students opportunities to learn about the technologies, through using of the technology itself, a method proclaimed advantageous by Borzak, 1981, Brookfield 1983 and Kolb 1984. ICT itself was therefore the main object of study. The two ICT teachers within the pilot group were trained in the use of the devices and informed of the practice within other projects, most prominently the Bradford 'Learning Everywhere' project. The device was pre loaded with tools, resources and content (and updated / synchronized using the Redhalo learning platform) to support the ICT qualification. An initial training session was also provided for students focusing upon the use of the device and associated resources, for their ICT course.

Lessons were delivered utilising the PDA's apposed to PC's in labs, encouraging communication between teacher and student and student and student through beaming (Bluetooth and infrared), with content dissemination through RedHalo. Homework tasks were set using software on the PDA's which was submitted through RedHalo synchronization. Mobile blogs were set up on the internet and used for meaningful and collaborative activities, which could extend beyond the classroom boundaries.

### **Horizontal Integration**

Although true horizontal integration could not be achieved within the scope of this project, attempts were made to enable this process. Content and resources were pre loaded onto the devices in support of the core subjects English and Mathematics, in order to raise attainment across the curriculum (owing to the low attainment within the cohort). The two selected English and Mathematics teachers were also provided with the same training as the ICT staff to help develop ideas for integration and usage. The notion surrounding this follows learning through space and time, and thus the teachers may suggest or learners may discover new ways of working and learning within these sessions and take them back to their ICT lessons and beyond.

Furthermore, senior leadership ensured all staff who would teach the cohort across the curriculum were aware of the project and would enable the students to utilise the devices within lessons (providing the students could justify the rationale).

Students who owned mobile devices in these sessions were given the opportunity to use the device within the classroom for note taking, voice recording, writing, producing concept maps and using academic content in support of their learning.

It is acknowledged that National Curriculum levels will probably not be affected in the short term of the pilot, but are be relevant for the extended project.

### **Dissemination**

The dissemination is not discussed within this document as the project itself is to inform practice (for the purpose of dissemination) at an early stage. The dissemination therefore is beyond the scope of the project. It is however, necessary to acknowledge this as the final intention for the overall project.

## **Evaluation**

Owing to the nature of the project i.e. concerned with innovation rather than outcomes, formative evaluation methods have been employed. The project was a pilot, based at the developmental stage of the RDD model, thus formative evaluation can provide an understanding of why different outcomes emerge, catch problems early on, address implementation questions, collect baseline data and identify the appropriate outcomes for the impact evaluations.

## **Data Collection**

To inform data collection and evaluation for the study, other innovative studies in the use of ICT and education were referenced to provide a sound model for data collection, notably the ImpaCT2 study of NGfL (Becta, 2001).

Data was collected as follows:

### **Teacher Researchers**

Teachers were required to produce bi-weekly reports of interesting practice (supporting objectives 1,2,6 and 7) and conduct small focus group discussions to draw on perspectives of teachers outside the identified pilot group (supporting objective 9); essentially gather data on use across the curriculum and 'authentic' use of the mobile devices (supporting objective 5).

### **Pupil Researchers**

In order to obtain detailed information of students' use of mobile technologies, both in and out of school, the students within the pilot group were required to conduct one compulsory task and one of two optional tasks. The compulsory task was to complete a weekly log book to track the use of mobile technologies in a typical student week (supporting objectives 1,2,3,4,5,6 and 7).

Optional tasks were as follows:

- Internet questionnaire – to identify where, when and how mobile technologies were used and interconnected via the internet (supporting objectives 1,2,4,5,6 and 7)
- Detailed report - a detailed focus upon use for a specific task or activity (supporting objectives 1,2,3,4,5,6,7 and potentially 9 dependant of the focus of the report)

Pupil research would also support objective 8 to trial providing personal access to mobile devices and their use through, first hand experience.

### **Active Researcher**

It was the task of the active researcher to make observations of the pupils use of the mobile technologies and gather first hand information

to inform praxis (supporting objectives 1 through 9). Much of the evidence collected, presented through this evaluation, together with associated conclusions and discussions, are based upon active research and observations throughout the project.

### **Pupil Questionnaires**

A pupil questionnaire was used to collect data on the perceived important aspects of mobile technologies such as ownership, access, functionality, collaboration, content, use in different curriculum areas (both within and outside the provision), social use and leisure (supporting objectives 1 through 9).

### **Concept Mapping**

Concept maps provide a visual tool for pupils to develop a mental representation of their understanding and perceptions of mobile technologies to support their learning. The primary purpose is to help interpret how students learn about ICT (mobile technologies) and how they learn with mobile technologies (supporting objectives 1,2,3,4,5,7 and 9).

### **Interviews**

Interviews were conducted following an initial analysis of the data collected as demonstrated above. A structured interview would enable further investigation of key findings to comprehend students actions.

## **Findings and Discussion**

This section presents the interim findings of the project making considerations of the positive indicators and lessons learned to inform the future praxis of the project at the dissemination level of the RDD model. This section proceeds with a two part structure; the findings and discussion with relation to personalised learning followed by findings and discussion surrounding wider implications of m-learning.

### **Personalised Learning**

Perhaps the most obvious benefit mobile technologies offered the project with relation to the personalised learning element of the pilot, was the ability to support anytime, anywhere access to learning and thus continuity of learning and out-of-hours learning; enhancing the opportunities to learn through development of home-school links (Harrison et al, 1998; Hennessy, 1998; Thomas and Pettigrew, 1999). Of the pilot group, only 24% of learners had previously enjoyed access to ICT and the internet within the home. Despite this low number, constant exposure to digital technologies such as mobile phones (owned by 100% of the pilot group) have arguably evolved our students into what Prensky (2001) describes as 'Digital Natives,' where our learners are 'always on,' mobile and experimental (Oblinger, 2003; 2004) and being in possession of an information technology mindset (McMahon & Pospisil, 2005). The provision of a mobile, information technology device helped embed learning and technology into the lives of our digitally driven students, with 24/7 access; where all students had an equal and fair means of accessing ICT and online learning; both within and outside the school, helping lessen the digital divide (Perry, 2003). The result was to remove barriers to learning and harness the informal learning which takes place outside the school boundaries; rooting learning in those unique skill sets and knowledge base of the individual learners and to increase the total time learners spent engaged in meaningful learning activity. Through analysis of pupil researcher reports, pupil questionnaire's and interviews, it is clear that pupils appreciated the opportunity to learn wherever and whenever they desired and were genuinely motivated to learn through the use of a PDA, with 100% of the pilot group proclaiming an enjoyment of learning using the PDA. To supplement this, teacher reports detailed how their learners seemed enthusiastic about learning using the mobile device substantially more than learning with either a desktop computer or without ICT, including hard to reach learners who had previously not engaged with learning. Following this finding, future praxis can exploit this notion with the intention of raising attainment through increase immersion in such meaningful learning activities.

Through analysis of data from student log books it was clear that students made the most substantial use of the mobile devices outside

of school. Students could *and did* learn whenever and wherever they wanted to; making choices about what they wanted to learn. The log books and concept maps demonstrated that the nature of learning differed vastly from student to student; revisiting lessons materials, listening to audio recordings, internet research, creating concept maps, playing learning games, word processing, reading etc. This demonstrates a desire to learn in an informal environment (home, bus etc) to link those activities which would occur within their daily lives to their individual learning requirements and learning styles. 100% of the concept maps created by students linked the mobile device to learning in some way, demonstrating students' internal representations of learning, technology and how they interact. Future development of the project will draw upon this finding; to stimulate learning in the informal environment and seek new ways to evaluate and appraise such informal learning in support of classroom based formal learning and assessment.

Perry (2003) suggests, enabling full time usage and ownership of any computational device has a significant impact upon users attainment, namely through the increased involvement learners have within their own learning. Owing to the short nature of this pilot we cannot derive any conclusive data to support this claim, however teacher and pupil reports and interviews have suggested a perceived raised attainment and a development of knowledge through ownership. Interviews with students suggest this ownership was perceived by the students whom discussed the notion of always having the PDA and thus always having learning. Both students and teachers also strengthen this notion through the use of personalised content delivered to the mobile devices which students perceived as 'their own' learning content. Furthermore, Passey (1999) explains that portable devices enable students to take work home and continue learning which can help foster greater feelings of ownership over work. Within the project it is clear that the mobile device provided the delivery vehicle to encourage ownership. Merchant and Monteith (1997) suggest this can heighten home-school links and encourage increased parental involvement. This was consistent with the findings of the project; through analysis of log books, it is clear that students continued to work and learn outside of school and 87.5% of parents helped support or expressed interest (defined as a minimum of three interactions per week) in their students learning; comparative to the 12.5% identified within the questionnaire prior to m-learning being introduced. Student concept maps also represented learning linked to family including parents, siblings and extended family. A possible explanation for the parental (and indeed family) involvement was the implementation model where parents made a financial contribution to the mobile device. However, owing to the small time scale of the pilot, we could not access the sustainability of this involvement. None the less, the

supplementary involvement from parents provided an enhanced knowledge of students capabilities, owing to an increase of learning activity situated within the home. This knowledge could then be shared with teachers and students (siblings) enabling assessment for learning (understanding of competencies) and thus providing a means for learners to be involved in their own learning process i.e. the choice to strengthen those competencies that they are aware require supporting. Through this extended knowledge of learners competencies and analysis of usage through the mobile learning platform, teachers were able to produce and provide personalised content for learners, either through appropriate 'ready made' content, or customized content (through development toolkits). Learners could then choose where and when to access this content, designed to allow students to gauge their current level and focus their efforts in the areas they identified as needing to improve. Through analysis of concept maps it could be suggested that students felt they were able to make a choice of how to use the mobile device to support any given learning topic; making decisions based upon their preferential and individual learning styles.

The use of mobile devices increased access to ICT within school. Through analysis, pupils were only receiving 28% of their school time with access to ICT prior to the pilot (time shared across both the school and the CLC), which, although 11% higher than the national average (even when a school meets all ICT requirements defined by Ofsted), still falls hugely short of the 100%, 1:1 access the personalised learning agenda sets to achieve. This afforded the exploitation of ICT and the developing skills of the students to support their own learning. An example of usage was to deliver customised content to learners in context, such as a game, video, short task, additional information or audio recording to i.e. a student whom was struggling with the classroom topic; at the specific time they required additional support; strengthening competencies through assessment for learning and providing ownership of learning and stimulating peer and mentor dialogue through mobile or face to face interactions.

In summary, the project proved concept of mobile technologies affording significant benefits to every aspect of the personalised learning agenda, affording enhanced learning opportunities for each individual student. The following (wider) discussions of m-learning focus upon those findings which, whilst not directly attributing to the evaluation strands of personalised learning, supported the learning process, thus having indirect implications on the agenda.

## **Wider discussions of m-learning**

### **Motivation, engagement and self esteem**

By providing ownership of a 'cool' device students engaged with learning in a way previously not encountered within the pilot group. With 100% of the students proclaiming motivation through the personal ownership of the mobile device. This was most evident through the most disaffected of the group, who were not previously committed to learning. Teacher reports demonstrated an early perception that the effect was novelty and thought it would wear off, however through the duration of the pilot this has not been the case and students cited being motivated by m-learning. This affords the project through an engagement with the technology and a means to access learning through a comfortable medium. M-learning has provided a vehicle in which students always have the means to discover the answer to a problem, thus ownership of learning. Weaker students who previously would not have offered an opinion or answer within classroom discussion, were able to use the device to increase their knowledge base at the exact time required, thus contribute effectively and confidently within lessons. This greatly aided self esteem as perceived weaker pupils were able to answer increasingly more complex questions. Through the use of a PDA, it was clear that students became more confident and felt they could succeed; leading to increased self esteem and worth; thus increased engagement with the curriculum and indeed a motivation to learn. Perry (2003) found increased motivation, organization skills and responsibility amongst pupils were key benefits of using mobile devices. One teacher detailed evidence of this within the pilot; a generally disruptive and irresponsible pupil was questioned in lesson regarding usage of the PDA (following the suggestion it was being used as a phone, not a learning device). The student was able to respond responsibly and intelligently, detailing why he had the PDA, what he was using the device for and how this would benefit this lesson and how it will help him learn. Such levels of maturity (and indeed capability) had never been seen with this student.

Accountability was extended throughout the group who, in order to maintain access to m-learning had to develop high levels of responsibility; even through fundamental tasks as maintaining the device, keeping it charged, bringing it to school, keeping the device securely etc. The level of responsibility for the devices was also demonstrated as no students lost their devices throughout the duration of the project and only 1 devices suffered (easily repairable) damage.

The ownership helped to build self esteem as students felt valued and trusted with the (perceived expensive) technology. In addition, the ownership of the device lead to ownership of learning.

## Literacy

Although the learners were involved within m-learning for a short time scale, teachers reported perceived improvements in their learners reading and writing skills. Pupils accessed 'e-books' and thus were reading for both learning and leisure, using the PDA. Of the group, prior to the project 0% of the pupils read outside of school, comparative to 62.5% who began reading using the PDA within the duration of the pilot, 33.3% of whom read for more than 1 hour a day. It could be argued that the efficiency of reading using a PDA is greatly reduced comparative to reading; a book owing to the notion we read 50% less quickly on a computer screen than paper (Independent, 2005). However, we must focus upon the re-engagement within reading and the associated gains for learners. The use of voice technologies within the device helped less able students, specifically those who struggled to read on the small screen (accessibility has been a major topic of discussion within m-learning and it is worth adding that the PDA solution is not the most appropriate tool for all. The personalised learning agenda itself suggests that we must strive to find delivery vehicles for personalised learning, and the fact every child has different requirements owes to the fact the solution may well be different for different learners), accounting for 16.7% of the group.

A similar discussion of accessibility has centralized around learners with motor control impairments and their disadvantage when using a stylus or small keyboard to write. However, we must also note the similar disadvantages when writing with a pen and pencil. Those learners who suffered motor control impairments (8.3% of the group), through the project, were able to learn to form letters correctly which they were then able to transcribe and print a fair copy. Learners with poor handwriting cited the transcriber as helping them 'write better'. For the one learner with more severe problems, the voice recorder provided an appropriate means of articulating ideas and work which was beamed to teachers. Improved handwriting was cited this as motivating as they no longer felt excluded due to poor read and written literacy.

The above suggest an ability of the students involved to overcome boundaries to learning through literacy disadvantages, to use the PDA's to articulate their digital language and focus upon the multiliteracies of our digital natives. It is suggested that we should perceive literacy within a broader social order where this new communication order takes into account screen based technologies (Snyder, 2001), taking into account the digital literacy of our students. By appraising this within the pilot, students self esteem was also increased as they felt valued for the digital literacy they had developed and could share with their peers.

### **Additional Teacher Perspectives**

Reports following teacher focus groups suggested a positive feeling among teaching staff, with very few apprehensions regarding the use of ICT. Analysis suggested the acceptance of mobile technologies within the classroom environment, seen as non invasive and required no additional time or effort (deemed essential). Further benefits cited were no need to 'log on' and the devices were always on and thus no time was wasted during boot up. The devices could be used in every lesson, without having to seek, book and move to IT labs for specific lessons; therefore overcoming a major barrier to ICT adoption in classroom praxis. This was extended through the ability to support their students from dispersed locations with personalised learning materials and dialogue.

### **ICT as a Tool**

Feedback from questionnaires shows that 88% of the student pilot group had a preference for a PDA over a laptop or tablet and through interview reasoning portability, functionality and ease of use. Of those respondents who suggested the alternatives, their reasoning centered around the lack of availability of software for the PDA, namely for media i.e. web design, animation or 3D gaming. Perhaps this is direction for future development for the PDA, or simply a case of selecting the most appropriate tool for purpose i.e. the higher processing power of a larger device to support such software is more appropriate for those specific purposes. This notion is parallel to that of accessibility discussed earlier in this evaluation.

### **Ubiquitous Computing**

As mentioned earlier in this paper, learning was not the sole usage of the devices by students. Log book, reports and concept maps showed usage included games and music (entertainment), SMS / MMS messaging and blogging, phone calls (socializing), use of still and video cameras and bluetooth file sharing (leisure). This was encouraged within the group in order to increase ICT capacity within the students and bridge the gap between the mobile phone literacy of our digital natives and their ICT capacity; demonstrated through an average of 92% of learners who suggested an increase in their confidence and ICT capability. Indeed, one notion of providing the device was to enable students to learn about new technologies (mobile technologies). Through learning *with* the technology, students engaged in peer dialogue to elicit new and innovative ways of using the device for all aspects of their lives. The ownership of a mobile device therefore became embedded within the learners' lives; an ambient and ubiquitous device. Concept maps from all students included learning alongside leisure and social activities; and through psychoanalysis, (in the vast majority) the size of the drawing (significance) for learning was consistent with that of most other activities. This suggests that a mobile

device such as a PDA facilitates all aspects of an individual's life. In addition, by carrying a ubiquitous device an individual never separates their social life, leisure activities, entertainment and learning. This notion has huge implications for education. If an individual never separates learning from their lives, then in every action and activity there is both an opportunity and an appropriate mindset to learn; delivered through an agent (i.e. a PDA) and thus ICT embedded into everyday life to increase those opportunities. In addition mobile devices such as PDA's afford benefits congruent with the aspirations of ubiquitous computing, where learning as a process is as ambient as the device which facilitates a learners life.

## **Conclusion**

This pilot study has identified the vast benefits afforded by the employment of mobile technologies to support learning and the personalisation of learning service. The study has provided proof of concept for the use of mobile technologies and it is clear that the research should be extended and disseminated upon a much wider scale, building upon the finding of this formative evaluation.

Interestingly, within this research (upon reflection), each node discussed within the context, implementation and evaluation are all notions congruent with the debate surrounding ICT and education, apposed specific to the use of mobile technologies. Mobile learning merely amplifies this debate; using ICT to enhance the opportunities to learn, through ubiquitous computing; where all interactions with the technology, including learning, are ambient processes. We, as educators must seek to harness the power and capabilities of mobile technologies and ubiquitous computing for our learners; to exploit the affordances of ICT, to evoke such changes in school to enhance provision through personalisation and to provide each and every learner with the means to 'be the best they can be.'

## Bibliography

Attewell, J (2005) **Mobile technologies and learning. A technology update and m-learning project summary.** Technology enhanced learning research centre, Learning & Skills Development Agency, London

Attewell, J. and Savill-Smith, C. (2004) **Mobile learning and social inclusion: focusing on learners and learning** In Attewell, J. and Savill-Smith, C. (eds) (2004) **Learning with mobile devices: research and development – a book of papers.** Learning & Skills Development Agency, London. [Internet] Available from: <<http://www.lsd.org.uk/files/pdf/1440.pdf>> [Accessed 18 Dec 06]

Baker, M. (1994) A model for negotiation in teaching-learning dialogues. **Journal of Artificial Intelligence in education.** 5 (2) pp.199-254.

Becta. (2001) **ImpaCT2 Emerging Findings from the Evaluation of the Impact of Information and Communications Technologies on Pupil Attainment,** [Internet] Available at: <<http://www.becta.org/impact2>> [Access 12 Nov 06]

Becta. (2005) **Personalising learning with ICT,** BECTA Coventry

Becta. (2006) **Planning for personalised online learning,** BECTA Coventry

Borzak, L. ed. (1981) **Field Study. A source book for experiential learning.** Beverley Hills, Sage Publications.

Brookfield, S. D. (1983) **Adult Learning, Adult Education and the Community.** Milton Keynes Open University Press.

Brown, J. S. & Duguid, P. (2000) **The social life of information.** Cambridge, MA, Harvard Business School Press

Chin, W.W. and Marcolin, B.W. (2001) **The Future of Diffusion Research.** The DATA BASE for Advances in Information Systems 32(3) pp. 7-12 ACM

Dillenbourg, P. & Schneider, D. (1995) Mediating the mechanisms which make collaborative learning sometimes effective. **International Journal of Educational Telecommunications.** 1(2-3) pp.131-146.

- Directgov, (2006) **Internet Access** [Internet] Available at:  
<<http://www.statistics.gov.uk/CCI/nugget.asp?ID=8&Pos=1&ColRank=1&Rank=176>> [Accessed: 01 Dec 06]
- Farmer, M. and Taylor, B. (2002) **A Creative Learning Environment (CLE) for anywhere anytime learning** Proceedings of MLearn 2002, European workshop on mobile and contextual learning. Educational research papers of the University of Birmingham, no 14 In: Taylor, J. (2003) **A task-centered approach to evaluating a mobile environment for pedagogical soundness**. MobiLearn Consortium [Internet] Available from:  
<[http://www.mobilearn.org/download/results/Mlearn\\_paper.pdf](http://www.mobilearn.org/download/results/Mlearn_paper.pdf)>  
[Accessed 16 Dec 06]
- Harrison, C. et al, (1998) **The Multimedia Portables for Teachers Evaluation**, Coventry: NCET/Becta
- Hennessy, S. (1998) **The Potential of Portable Technologies for Supporting Graphing Investigations**. Milton Keynes: Open University
- Houle, C. (1980) **Continuing Learning in the Professions**. San Francisco: Jossey-Bass.
- Jonassen, D. H. et al (1999) **Learning With Technology: A Constructivist Perspective**. Columbus, Ohio, Merrill/Prentice-Hall.
- Kolb, D. A. (1984) **Experiential Learning**. Englewood Cliffs, NJ.: Prentice Hall
- Laurillard, D. (1999) A Conversational Framework for Individual Learning Applied to the 'Learning Organisation' and the 'Learning Society'. **Systems Research and Behavioural Science**. 16, 113–122
- Lave, J. and Wenger, E. (1991) **Situated Learning. Legitimate peripheral participation**. Cambridge, University of Cambridge Press.
- Leadbetter, C. (2005) **Learning about Personalisation: how can we put the learner at the heart of the education system?** [Internet] Available from:  
<<http://www.standards.dfes.gov.uk/innovation-unit/pdf/Learningaboutpersonalisation.pdf?version=1>>
- McMahon, M. & Pospisil, R. (2005) **Laptops for a digital lifestyle: Millennial students and wireless mobile technologies**. Proceedings of ASCILITE 2005 [Internet] Available from:  
<[http://www.ascilite.org.au/conferences/brisbane05/blogs/proceedings/49\\_McMahon%20&%Pospisil.pdf](http://www.ascilite.org.au/conferences/brisbane05/blogs/proceedings/49_McMahon%20&%Pospisil.pdf)> [Accessed 04 Nov 2006]

Merchant, G. and Monteith, M. (1997) **Laptop as messenger: An exploration of the role of portables in home-school liaison** Reading, 31 (2), pp. 22-25

Microsoft and Wolverhampton City Council , 2005 **Wolverhampton City Council Mobilises Learning to Give Students Access to Anywhere, Anytime Education** [Internet] Available from: <[http://www.microsoft.com/asia/case/casedetail\\_emea.asp?casestudyid=16914](http://www.microsoft.com/asia/case/casedetail_emea.asp?casestudyid=16914)> [Accessed 04 Dec 06]

Moseley, D. and Higgins, S. (1999) **Ways forward with ICT: Effective Pedagogy using Information and Communications Technology for Literacy and Numeracy in Primary Schools.** Newcastle, University of Newcastle

O'Malley, C. et al. (2005) **MOBlearn WP4 – Pedagogical Methodologies and Paradigms. Guidelines for learning/teaching/tutorial in a mobile environment.** [Internet] Available from: <<http://www.mobilearn.org>> [Accessed 22 Dec 2006]

Oblinger, D.G. (2003) **Boomers & gen-Xers, millennial: Understanding the “new students”** EDUCAUSE Review 38(4) pp. 37-47

Oblinger, D.G. (2004) **The Next Generation of Educational Engagement.** Journal of Interactive Media Education (8)

Papert, S. (1999), **Logo Philosophy and Implementation.** [Internet] Available from: <<http://www.microworlds.com/company/philosophy.pdf>> [Accessed 04 Jan 2007]

Passey, D. (1999) **Anytime, Anywhere Learning Project Evaluation Focus.** Lancaster: Lancaster University/AAL

Perry, D. (2003) **Handheld Computers (PDAs) in Schools,** Becta

Piaget, J. (1970) **Science of education and the psychology of the child.** New York, Orion Press

Perry, D. (2002) **Portable computers in primary schools: Literature Review.** Lambeth Education Action Zone Psion netBooks Project

Prensky, M. (2001) **Digital Natives, Digital Immigrants** In **On the Horizon,** NCM University Press 9(5)

Prensky, M. (2005) **What can you learn from a Cell Phone? – Almost Anything.** [Internet] Available from:

<[http://www.marcprensky.com/writing/Prensky-What\\_Can\\_You\\_Learn\\_From\\_a\\_Cell\\_Phone-FINAL.pdf](http://www.marcprensky.com/writing/Prensky-What_Can_You_Learn_From_a_Cell_Phone-FINAL.pdf) [Accessed 29 Nov 2006]

Rogers, C.R. (1996) **Freedom to Learn**. Columbus, OH, Merrill

Rosenberg, M. (2002) **e-Learning: Strategies for Delivering Knowledge in the Digital Age**. McGraw-Hill

Sampson, D. and Karagiannidis, C. (2002) **Personalised Learning: Educational, Technological and Standardisation Perspective**, CE.R.T.H, Greece

Scardamalia, M. & Bereiter, C. (1994) Computer support for knowledge-building communities. **The Journal of the learning sciences**, 3(3) pp.265-283

Shakespeare, W. (1595) **Love's Labour's Lost**

Sharpley, M. Taylor, J. Vavoula, G. (2005) **Towards a theory of Mobile Learning** [Internet] Available from: <<http://www.eee.bham.ac.uk/sharplem/Papers/Towards%20a%20theory%20of%20mobile%20learning.pdf>> [Accessed 22 Nov 06]

Snyder, I. (2001) **A new Communication Order: Researching Literacy Practices in the Network Society**. Language and Education 15(2) and (3) pp. 117-131

Thomas, A. and Pettigrew, N (1999) **The Use of Multimedia Portables in Supporting the Achievement of the National Professional Qualification for Headship: An Evaluation**. DfEE Research Report RR92. London. DfES

Van der Zee, H.J.M. (1997) (In Dutch) **Denken over dienstverlening**, Deventer: Kluwer Bedrijfsinformatie

Veerman, 2000).

Knowles, M.S. & Holton, E.F. & Swanson, R.A. (1998) **The adult learner**. (5<sup>th</sup> Edition) Houston, Gulf Publishing

Vygotsky, L. (1978) **Mind in society**. Cambridge, MA, Harvard University Press

Wood, C. (2003) **Introduction to Mobile Learning** [Internet] Available from: <<http://ferl.becta.org.uk/display.cfm?resID=5192>> [Accessed 09 Dec 2006]