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Welcome Letter

David Metcalf, Ph.D.

On behalf of the organizing committee from the University of Central Florida and the International Association for Mobile Learning (IAmLearn), we would like to welcome you to the 8th World Conference on Mobile and Contextual Learning – mLearn 2009. We thank you for your participation and hope you will find the conference an engaging and dynamic opportunity to interact with global leaders in mobile learning research. As we welcome you to Orlando, it is our distinct privilege to be the first US host of this prestigious event.

This mLearn 2009 proceedings offer new ideas, innovations, learning models, and evidence-based results of projects and research programs from around the world. Long papers, short papers, and posters provide details of the projects and their results. As we planned the event and looked at past conference research and current trends, four topic areas emerged as most prominent: Global Development, Contextual Learning, Emerging Technology Integration, and Emerging Vertical Applications. These themes have a wide variety of sub-topics focused on learning, technology, culture, and specific application of the technology to real-world problems in education, the workplace, and society.

Contents by Track offers an opportunity to focus on specific topics of interest:

- **Global Development.** We were pleased to see papers on emerging markets, cultural translation, globalization issues, and differences in pedagogy across the globe.

- **Contextual Learning.** This track offers a focus on learning innovation that is made possible through the technology advances for personalized, just-in-time learning. One-on-one and situated learning are enabled through the ubiquitous nature of small handheld devices. The addition of location-based services and other integrated measurement instruments provide an even greater degree of personalization and context-sensitive delivery.

- **Emerging Technology Integration.** Technologies for context and ubiquitous learning are one aspect of the increasing role of emerging technology integrated with mobile. Innovative solutions that offer links between mobile devices and other Web 2.0 technologies are surfacing both in labs and in the marketplace. Advanced collaboration techniques that can be delivered on both a mobile device and a desktop or laptop computer are paving the way for new learning approaches and higher-order learning that is used in the classroom and on the go. Mobile technology is also being integrated into games, simulations, and virtual worlds at the same time that mobile games for entertainment are proliferating. Combined with location-based services, augmented reality, mixed reality, telepresence, and augmented cognition technologies, there is a long and bright future for research and development initiatives that integrate mobile into a broader context of blended learning.

- **Emerging Vertical Applications.** Finally, innovation driven by specific segments of the education space, the corporate marketplace, non-profit organizations, and government and military needs are driving use and adoption at a prolific rate. New applications specifically targeted at a particular learner population in order to enhance human performance are guiding customer-driven innovation.

Designing solutions specifically to a broad or narrow audience will often produce the most dramatic results and drive user adoption rates as the technology becomes seamlessly integrated into how we learn, work, play, and live. As our discipline continues to evolve, we foresee a rich variety of potential research problems that we could tackle together in the future.

Areas of potential challenges and opportunities related to learning and research include cultural and regional differences, the lack of understanding of learning models and affordances, and the difficulty in producing repeatable field studies.

On the technology front, we will need to address a constantly fragmenting marketplace with competing devices and standards, integration with advancing and emerging technologies, transferring and scaling pilots to operational offerings, linking to lowest common denominator systems in developing nations, determining the relative value of app vs. mobile browser-based web development, and accessibility for disabled users.

Several environmental factors are important to consider as well, such as political and governmental regulation, potential long-term health risks associated with wireless technology, societal risks from misuse (texting while driving), classroom vs. extracurricular use, privacy and security (cyber-stalking and cyber-bullying).

With our combined efforts, we can address these challenges and opportunities in new ways. Through our research, we can drive theory to practice and help shape the future of our mobile world.

We hope that you will enjoy reviewing the papers, the presentations as well as the networking opportunities that mLearn 2009 in Orlando offers. The ideas generated, relationships formed, and future innovations planned will provide cohesion for our current projects and the forward growth of our field. Finally, we would like to thank the IAmLearn for their selection and ongoing support. We hope this will drive many years of fruitful collaboration.

Thank you,

David Metcalf, Ph.D.
Conference Chair
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Empowered Learner Identity through M-learning; Representations of Disenfranchised Students' Perspectives

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ABSTRACT
The potential of e-learning has been promoted for education internationally for many years. For disenfranchised learners, many forms of e-learning are just as alien as the educational systems they have already rejected. M-learning utilises technologies, activities and social systems that are already integrated into many people's lives, including those who have had limited access to or rejected formal education systems. This paper discusses two projects conducted in Northern Australia that explored a range of e-tools to support Indigenous students' engagement and recognition of their knowledge and contexts. This approach challenges educational institutions to connect to students' lives and contexts. The paper focuses on showing the ways participants utilised m-learning to demonstrate their diverse knowledge systems, the decisions they made about representing knowledge though m-learning and the implications for trainers and assessors.

Author Keywords
Learner Identity, Disenfranchised learners, regional communities

INTRODUCTION
E-learning … offers the opportunities for different modes of interaction involving many more people from diverse cultural backgrounds. This involves a new set of literacies (Bowles 2001:102) and relationships with learning and technologies. Approaches to learning that build on strong relationships with technologies utilise mobile technologies, these mobile learning tools have been taken up by many disenfranchised learners and are located in their own contexts. An exploration of a project conducted with Indigenous learners in Northern Australian remote communities found that m-learning was a powerful tool in recognising knowledge and building confidence in the students as learners. For many learners, m-learning has the potential to include Indigenous people in the development of new approaches to learning and the co-production of knowledge that address the skills and qualification gaps needed to gain successful employment outcomes.

BACKGROUND
The role of e-learning in a knowledge economy is recognised in the European Union's approaches to lifelong "*e-learning that use e-learning for promoting digital literacy and thereby contribute to strengthening social cohesion and personal development and fostering intercultural dialogue"* (Decision No 2318/EC of the European Parliament and of the Council, December, 2003). The potential of e-learning to improve educational and employment outcomes has been adopted eagerly in Australia and particularly by Indigenous learners ready for a positive learning experience in the formal education system. M-learning has been a key component of approaches that explore the potential of digital technologies to negotiate meaningful education and workforce development experiences. Any definition of m-learning in terms of hardware and software helps in recognising m-learning tools in daily life, but is limited by the technology advances at the time of any publication. It may be more useful to describe m-learning in terms of its use and purpose. Mobile technologies are frequently connected to people's lives, are used for people's own purposes for communication and connection beyond the educational.

Mobile devices are characterised by their potential for making connections through spontaneous collaboration and communication, location focused information, being readily available i.e. within sight, beaming information between devices and providing portable means of collecting and sharing audio and visual information (Kukulska-Hulme and Traxler, 2005). Mobile devices provide opportunities for a wider group of people to create and share new forms of information using multimedia forms for their own purposes. Some examples are collecting videos on a mobile phone, creating a digital story, and responding to an automated bill by text message or a wedding invitation by MMS (Multimedia Messaging Service).

The use of mobile technologies in learning environments has been integrated into formal educational contexts to enhance the communication of knowledge and development of ideas between learners, experts and their peers. 'The mobile learning community has demonstrated that it can (t)ake learning to individuals, communities and countries that were previously too remote, socially or geographically, for other educational initiatives' (Traxler, 2008:9). Access to mobile technologies and m-learning pedagogies can provide learners (including teachers) meaningful, context driven ways to introduce and share their knowledge and worlds. The use of m-learning approaches presents people opportunities to

engage with a range of knowledge sets, constructs and contexts beyond those in formal or desk based educational settings. Through educational experiences, learners can use m-learning to make connections between learners' worlds, make unfamiliar contexts more accessible and create ways of interpreting knowledge that reflect different ways of knowing.

A recognition of formal education sites as socially contested sites where power relations impact learners' and teachers' experiences helps to understand the nature of engagement and disengagement. The alienation and disconnection of learners from formal education institutions and experiences has been explored by Smyth and Hattam (2005) and Te Riele (2003:148-150), who note the reasons for disengagement from formal education have related to the rigidity of school systems, negative relationships with teachers, lack of feeling accepted or supported and the lack of connection between the curriculum and students' own lives. Field (2005) argues those that are most socially engaged demonstrate the values and attitudes related to demonstrating a sense of agency and being able to 'exert control over key parts of one's life' (Field 2005:144). Those who are disengaged from formal education are disenfranchised from associated knowledge resources, including a sense of efficacy as a learner at an individual and community level (Field, 2005).

Boyle and Wallace (2008) note that integrated e-learning developed with Indigenous people "*is more than understanding the technological or ICT resources but addressing organisational, systemic, pedagogic and cultural issues that challenge policy, educational institutions and systems, educators and educational brokers…* (There is a) *need to work with educational policy, institutions, trainers and brokers to re-imagine VET in Indigenous contexts and then, together consider a new way to structure, fund and support remote Indigenous peoples' learning through e-learning*". The potential for utilising m-learning to improve educational outcomes, then, is only realised by the degree to which m-learning is implemented in ways that support learners, trainers and policy makers to reconceptualise learners, their understandings of the world and to make connections to meaningful learning experiences.

THEORY

Critical and social theorists have informed understandings of the structures and processes within society. The impact of these theories in relation to learning, education and social and cultural reproduction is evident in critical perceptions of knowledge, agency, cultural and social practice. A consideration of learning and engagement in formal and informal learning experiences is informed by an analysis of key concepts within the social order. Lave and Wenger (1991:50-1), in their description of a social theory of practice, note the 'relational interdependency of agent and world, activity, meaning, cognition, learning and knowing. It emphasizes the inherently socially negotiated character of meaning and the interested, concerned character of thought and action of persons-in-activity. This view also claims that learning, thinking and knowing are relations among people in activity in, with, and arising from the socially and culturally structured world. This world is socially constituted; objective forms and systems of activity, on the one hand, and agents' subjective and intersubjective understandings of them, on the other, mutually constitute both the world and its experienced form.'

For Bourdieu (1990), knowledge is socially constructed, mediated and open ended, developed through individual and collective action. A social theory of practice is used to understand the practices that inform social systems and institutions and impact on individuals and groups in society. Bourdieu, in describing habitus, the socially constructed systems or principles that generate and organize practice and representations, explores the essentially socially negotiated nature of meaning. Habitus is historically produced, producing individual and group activities, social practices can be understood in terms of the conditions under which they are generated and implemented, and the interrelationship between the social worlds that 'habitus performs, while concealing it, in and through practice' (Bourdieu, 1990).

Berger and Luckman (2002:46-7) found that society and institutions are produced by people, people are socially produced and then experience the world they have created objectively and with the transmission of that social world to the next generation, the whole process is enacted. They describe the ways that institutions require legitimatisation and justification; institutions are understood in terms of the knowledge of its members, and this knowledge institutionalizes members' behaviour and intersections. 'Since this knowledge is socially objectivated *as* knowledge, that is, as a body of generally valid truths about reality, any radical deviance from the institutional order appears as a departure from reality' (Berger and Luckman, 2002:49). Knowledge is fundamental to the functioning of society, ordering the world, the language to describe it, understanding and reproducing social reality (p49-50).

Gore (2001) recognises the importance of understanding the ways power relations operate at a micro level of pedagogical practice that function through surveillance, normalisation, exclusion and distribution. Understanding the social practices related to learning, and the representations of knowledge systems and governance and their impact on learners, provides insight into the processes and institutions that operate and ways to proactively respond to the outcomes. This is particularly valuable in highlighting the invisible but transformative processes that impact learning engagement and outcomes. The potential for utilising m-learning in connection with social lives and creating effective and empowering learning experiences for disenfranchised learners is examined through the following case study.

CASE STUDIES

Working from Our Strengths – Recognising and building literacy through the Training and Assessment Competencies was a project built on the work of Indigenous enterprise operators in remote communities across Northern Australia to develop effective strategies to ensure relevant, quality training and qualifications are implemented that support economic independence and knowledge management at a local and national level. Funded by the Department of Education, Science and Training, the project used e-learning tools and technologies to support Indigenous enterprise operators' need to map the development of a training plan with their current and potential staff. The processes recognised the knowledge that is developed and owned by that enterprise, and establishes opportunities for leading e-learning training for Indigenous people involved in enterprise training. Established Indigenous tourism enterprise operators and staff from a range of Indigenous businesses participated. Participants undertook recognition of prior learning (RPL) and current competence (RCC) processes that reflect the work undertaken in locally based enterprises and Aboriginal businesses using digital photographs, videos and stories, m-portfolios and web-based conferencing. The final product outlined the process for developing a training plan with an Indigenous enterprise team, ways to use m-tools to collect evidence and examples of successful e-applications for RPL and training plans.

This Australian Flexible Learning Framework project, Working from Our Strengths: Using e-learning to recognise knowledge and competence in Indigenous enterprise training and development, focused on enhancing practitioners' ability to work in flexible ways with diverse client groups and develop innovative and flexible approaches to assessment and skills recognition. This project identified the VET industry-specific English-based literacy inherent in the Certificate IV in Training and Assessment, and recognised a range of cultural, workforce, digital, visual and other literacies. These literacies are necessary to engage in workforce learning and development, or to establish and sustain a viable enterprise that offers ongoing and valued employment in regional and remote Indigenous communities. Participants identified the literacies evident in their learning and workplaces and the ways these were identified or developed over their studies. Each participant identified the need to develop expertise and qualifications as a trainer, supervisor or assessor in their industry area to build their enterprise opportunities and capacity within their homeland/outstation/community. The final product outlined a series of guidelines for recognising and assessing competence in a range of literacies, and provided examples of approaches and tools to recognise and assess the identified literacies. This paper reflects on the outcomes of the projects in light of the social learning theoretical framework described.

FINDINGS

While the projects started by considering a range of e-learning approaches, m-learning strategies and resources were found to be most useful. The projects were based in remote Indigenous communities, and were best managed by collecting and organising information with people while they were involved in relevant work based and learning activities. In low ICT infrastructure and support environments, it was beneficial not to rely on complicated technology and use approaches that can work anywhere, anytime. M-learning approaches, such as using laptops and cameras, were less intrusive and already integrated into people's daily lives, even if they were not used regularly by participants. M-learning based evidence collection strategies ranged across making digital stories and audio files to collating images and texts from various sources. Once these were accepted by students as viable, people identified a broad range of ways to collect evidence.

Of particular benefit were peer teams who collected evidence for each other in their own workplace contexts and then reflected on the images and recordings before remixing the information to be presented to the assessor. As the learning and evidence collection strategies were a part of people's lives and accepted made different ways to think about what is involved in learning and what counts for assessment. This encouraged people to focus on what they can do, and how to document and communicate it so others could recognise those skills and competences. Learners also noted the empowerment they experienced by being involved in a learning process that included their worlds, worked from their own strengths in managing information and included more than text based ways of making connections. Assessors found alternative ways of recognising students' knowledge, strengths and potential points for connection around assessment.

The team developed approaches to learning, representing and creating knowledge, sharing ideas and assessing competence with Indigenous participants to better represent and reflect Indigenous people's existing and growing strengths and knowledge. This included the use of video, audio, digital stories, websites and m-portfolios. The potential use of the e-learning tools were not always expected, and developed with participants as teams grew in confidence and knowledge about what was possible. The ownership of the final outcomes was shared, which was reflected in the accurate representations of Indigenous people, the appropriate representation of sensitive differently about their learning and use of e-learning generating a series of work across projects that was unexpected. This was most effective when Indigenous people were involved at every stage. Trust is the cornerstone of co-production and was the focus for developing strong relationships across people, groups and institutions. The critical mass of knowledge and resources was key in gaining external and agency support for project teams and their ideas.

The Indigenous people involved are proficient in a number of languages; m-learning tools provided an opportunity to record ideas and examples of their competence in their first language, reflect on the material while in situ and then translate that information, initially across language, but also across cultures. The m-learning tools were useful for demonstrating alternative ways of interpreting a learning event and to demonstrate competence. This was useful not only for the learners, as they could assess their own skills and discuss what they meant by referring to images and recordings within context, but also for off-site assessors who came to appreciate the learners and their context in a new way. This process helped to develop new relationships that focused on competence and strength rather than deficit notions of people or learning.

DISCUSSION

The social nature of learning was evident in emergent learning and other social practices as they related to technological development, and includes e-learning and m(obile)-learning that utilized the associated social practices to enhance

learning and engage learners. The emergence of new forms of literacy, knowledge transfer and co-production are exemplified in the development of technological approaches to learning; i.e. e-learning and m-learning, the essential emergent social practices have an important impact on the ways learning approaches develop and technologies are used. (Kress and Pachler, 2007; Kukulska-Hulme and Traxler, 2005)

Effective training recognised the importance of working with local community knowledge about governance, cultural knowledge, land ownership, and enterprise owners' priorities for the business and their lives. Digital knowledge systems and resources offered considerable opportunities to work in new ways. The mobile technology used in the project has become increasingly intuitive and accessible in remote areas, making the use of ICT more viable. Digitally based resources supported people to learn and demonstrate competence across language and knowledge systems. The use of mobile technology in training was negotiated rather than mandated, which resulted in unexpected use of technology to share ideas and implement the outcomes into the enterprise's' business plan. Key to this is the role of Indigenous people in the development of the resources, using software and hardware resources within the enterprise and collecting evidence through an e-portfolio. The optimal use of multimedia is used in the normal operation of the workplace and any training built the capacity and resources for that enterprise. Visual and audio means were used to demonstrate competence that has hitherto been unrecognised by assessors and ensure students are assessed fairly and accurately.

M-learning supported effective approaches to learning. The m-learning extended and deepened the ways learners could explore, analyse and create knowledge in meaningful ways. M-learning approaches developed materials that articulated what is meaningful to learners and the power of connection between people's lives and diverse forms of knowing and being. The use of m-learning led by Indigenous students and teachers led to representations of students' knowledge systems that challenged assessors to think differently about students' capacity, to focus on their strengths and complex contextual knowledge rather than in deficit terms, in relation to expectations of English and knowledge of mainstream systems.

Learners, more than consumers, are producers and teachers of knowledge and ideas as they relate to specific contexts (Gee, 2003). Learners are active interpreters of all learning, including m-learning, its use and potential. These interpretations relate to a sound understanding of the relevant context and relationship to people, places and knowledge systems. In an analysis of the ways Australian Aboriginal people produced resources in their own digital environments, Christie (2007:2-3) noted:

> (*Aboriginal*) People use the digital resources in a social context as props or artefacts, in the same way that they would use nondigital resources like paintings, photos, diagrams, ceremonial objects, and of course the land itself and natural phenomena in talking about and representing themselves and their histories, and making agreements… the use of Aboriginal digital resources is serious business, making claims about ownership, about rights and responsibilities, and appropriate behaviour. In these cases the ways that the resources are identified and validated, the way they are accessed and displayed and the ways assemblages are put together and used in context, is a crucial part of the knowledge production process, and negotiations over resources.

The case study demonstrated the need to develop a straightforward, multilingual m-learning tool that will build the digital literacies of learners and trainers beyond the formal learning situation, and supports the integration of m-learning into people's lives and lifelong learning experiences. This work has commenced with Aboriginal youth in the Northern Territory who are interested in extending their use of m-learning for their careers and engagement in a range of worlds. One of the most important challenges for trainers then, is to hand over the power over m-learning experiences with the ownership of the m-learning tools. M-learning works when the mobile technology is a part of people's lives and they own its creation, manipulation and production into other forms. This also means adapting to different ways of representing and linking information, to other forms of knowledge, to the external world, to the local and global communities and to education. The ways that this knowledge is treated, the ways it is assessed, recognised, legitimated and branded, has significant impact on disenfranchised learners' engagement in a range of learning experiences. Supporting the integration of learners' lives, as they see and interpret them, through the use of m-learning that includes many languages, images and voices builds strong connections to disenfranchised learners' worlds and the potential for those learners to take the lead in their own learning journey.

The impact of using m-learning tools was their role in developing empowered learner identities. Learners who were empowered are able to sustain their engagement in learning through challenges to their learning experiences and how the learner identities on which they drew helped to address those challenges. For many learners the successful resolution of the contradictions between the learner recognised and imposed by local, peer, workplace and educational institutional communities is related strongly to individual's belief that they should have a role in the education system (this did not mean being compliant; participants described their role was to master, maintain their own integrity as a learner and community member and, for most, challenge the existing paradigm). This attitude tended to be more important in being successful than the strategy used. Supporting students' identity and participation is more than teaching a range of strategies; it was about resolving the nexus of membership that includes educational institutional community membership. The learners, who managed to continue engagement for a part of their programme, described their learner identity as it related to the institution and their own community. They were able to negotiate strategies that worked for them to actively participate. This was optimised when students were able to make strong connections to their own purpose and understanding of the world. This was the power of m-learning, where learners developed ways to negotiate how they saw themselves, and how others saw them, as competent learners in their own right and in relation to new knowledge.

CONCLUSIONS

Effective approaches to learning might best be exemplified in video gaming, where as Gee (2003) notes, learners direct their learning, are able to repeat parts as often as they choose, learning has consequences that are personal to the learner, learning is linked to a range of global and local communities, experimentation is encouraged, learning is highly customized and responsive and has inherent rewards. In this way learners are engaged in their own learning, act as co-producers of knowledge and build connections to their own and others' knowledge and skills as they see fit and when they are ready.

M-learning tools can be used to focus learning on exploring learner contexts, local and global knowledge. By recognising the diverse knowledge systems and contexts of a range of disenfranchised learners such as youth, regional communities and small enterprise owners, there are opportunities to build bridges between their worlds and that of formal education curriculum. The bridges provide points of connection and sharing, not for one to dominate or denigrate the other, but rather to make connections in order to share ideas, build mutual understanding and extend possibilities for learning. M-learning approaches can be implemented to involve disenfranchised learners in positive learning experiences and active construction of knowledge and learner identities. Learners are able to work with and be assessed using material from their worlds as they relate to the worlds of work, community life and lifelong learning, to explore new possibilities and develop strong empowered learner identities.

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Mobile Web 2.0: from Pilots to the Mainstream

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ABSTRACT
This paper presents an evolving mlearning implementation plan for a tertiary education institution. Following an introductory mobile web 2.0 project in 2007, five small projects in three different disciplines were launched in 2008. Following the success of the 2008 projects, a series of wider scoped projects are planned for 2009. Drawing on these previous experiences, and those of similar mlearning projects at other institutions, a support and implementation plan has been developed. This paper briefly discusses identified critical pedagogical success factors, and key strategies for moving from mlearning pilots to mainstream implementation in 2009.

Author Keywords
Mobile, Social Constructivism, Web 2.0, Moblogging, Action Research, Communities of Practice

INTRODUCTION
The 2009 New Media Consortium Report identifies Mobile Devices as a key emerging technology within tertiary education. “Already considered as another component of the network on many campuses, mobiles continue to evolve rapidly. New interfaces, the ability to run third-party applications, and location-awareness have all come to the mobile device in the past year, making it an ever more versatile tool that can be easily adapted to a host of tasks for learning, productivity, and social networking. For many users, broadband mobile devices like the iPhone have already begun to assume many tasks that were once the exclusive province of portable computers.” (Johnson *et al.*, 2009)

Five small (each involving between 6 and 10 students and their lecturers) mlearning projects were implemented and evaluated during 2008 (Cochrane, 2008). Feedback from the 2008 mobile projects was very enthusiastic:

> It isn’t ‘easy’ working in this way but it is immensely valuable and exciting. I think that it would be very hard go back to traditional teaching only methods now I have begun to use blogging and mobile blogging. (Third year Bachelor Product Design lecturer).
>
> I really really enjoyed the process, it was great. The things I liked were being able to be completely mobile, and having access to the Internet – you know, if I was lost or if I needed to find someone, or I needed to ring a business. I could go on the Internet, Google their website, look up their opening hours, things like that... (Bachelor Product Design student)

Compilations of 2008 student and staff VODCasts (Online video recordings) are available on YouTube:

1. BProduct Design Year 1 - http://www.youtube.com/watch?v=8QUfw9_sFmo
2. BProduct Design Year 2 - http://www.youtube.com/watch?v=6jwAFXBZAz0
3. BProduct Design Year 3 (and Lecturers) - http://www.youtube.com/watch?v=8Eh5ktXMji8
4. DipContemporary Music - http://nz.youtube.com/watch?v=0It5XUfvOjQ
5. DipLandscape Architecture - http://nz.youtube.com/watch?v=c8IZSVtaMmM

Following this enthusiastic response from the students and lecturers, internal institutional funding was sought and approved for extending these small projects to a major large-scale mlearning project in 2009, involving the use of 250 smartphones and 200 netbooks. The project is driven by pedagogy.

Pedagogy:
The mobile learning projects are based on an explicit social constructivist pedagogy (Kim, 2001). Herrington’s chapter “Authentic Learning Environments” (A. Herrington & Herrington, 2006) illustrates one approach to the establishment of social constructivist learning environments.

The focus is on student-generated content, collaboration and communication, not on content delivery from lecturers to students. Therefore an explicit social constructivist pedagogy underpins each project. Mobile Web 2.0 tools are used to facilitate this (web 2.0 services that are formatted for use with mobile devices). Many educators have harnessed web 2.0 tools for creating engaging student-centred learning environments. This appropriation of web 2.0 tools within a social constructivist pedagogy facilitates what has been termed “pedagogy 2.0” (McLoughlin & Lee, 2008). This research project is interested in appropriating the benefits of web 2.0 and pedagogy 2.0 anywhere, anytime using mobile web 2.0 and wireless mobile devices (or WMDs). Figure 1 below is a concept map developed to graphically illustrate the links between multiple learning contexts and web 2.0 technologies that the smartphones afford.

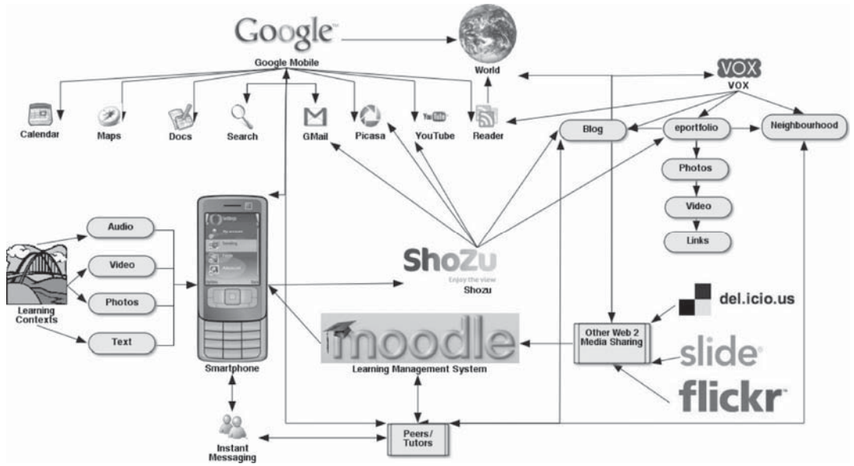

Figure 1. Mobile Web 2.0 concept map.

The pedagogical potential of smartphones is in their ability to ‘bridge’ learning contexts (Vavoula, 2007), providing the ability for lecturers to facilitate social constructivist learning environments that connect both the formal and informal contexts, facilitate peer support, and thereby situate learning within ‘authentic learning environments’ (A. Herrington & Herrington, 2007; 2006). It is the potential for mobile learning to bridge pedagogically designed learning contexts, facilitate learner generated contexts and content (both personal and collaborative), while providing personalisation and ubiquitous social connectedness, that sets it apart from more traditional learning environments. Mobile learning, as defined in this project, involves the use of wireless enabled mobile digital devices (Wireless Mobile Devices or WMDs) within and between pedagogically designed learning environments or contexts. From an activity theory perspective, WMDs are the tools that mediate a wide range of learning activities and facilitate collaborative learning environments (Uden, 2007). In particular, the context bridging and media recording capabilities of today’s smartphones make them ideal tools for mobile blogging. Smartphones allow a user to send text, photos, video and audio directly from the site of recording to the user’s online Blog. An example of the potential of mobile blogging is the rise of citizen journalism (Cameron, 2006; Elmendorp, 2007; Fulton, 2007; Skoeps, 2007). Collaboration and communication with peers and tutors can be maintained in any context using WMDs with a variety of communication technologies (email, online LMS, Instant Messaging, audio and video conferencing, SMS, MMS, mobile phone calls etc…) thus linking multiple contexts into the learning environment, continuing learning ‘conversations’ via social presence and communication technologies.

The learning outcomes for students are

- Developing critical reflective skills
- Experiencing and developing group communication skills
- Developing a life-long online eportfolio that showcases their potential
- Developing a potentially world-wide peer support and critique and support network
- Learning how to maximise technology to enhance their learning experience across multiple contexts

METHODOLOGY

Participatory Action Research
The research uses a participatory action research methodology. Yoland (Wadsworth, 1998) identifies the key characteristics of 'participatory action research': the researcher is a participant, the researcher is the main research instrument, it is cyclical in nature, involves action followed by reflection followed by informed action, and is concerned with producing change. This change is ongoing throughout the process, and the research is interested in input from participants/stakeholders. This allows for the continual development and improvement of the projects based on the feedback from participants at regular points in the projects.

Research Questions

1. What are the key factors in integrating Wireless Mobile Devices (WMDs) within tertiary education courses?
2. What challenges/advantages to established pedagogies do these disruptive technologies present?

3. To what extent can these WMDs be utilized to support learner interactivity, collaboration, communication, reflection and interest, and thus provide pedagogically rich learning environments that engage and motivate the learner?
4. To what extent can WMDs be used to harness the potential of current and emerging social constructivist e-learning tools?

Data gathering consists of:

1. Pre-trial surveys of lecturers and students, to establish current practice and expertise
2. Post-trial surveys and focus groups, to measure the impact of the wireless mobile computing environment and the implementation of the guidelines.
3. Lecturer and student reflections via their own blogs during the trial.

Participants

The projects are collaborative partnerships between the researcher, the course lecturers, and course students. Potential courses have been identified by the researcher, and the projects are developed in conjunction with volunteering lecturers. Students and teaching staff will be provided with a 3G smartphone for the duration of the trial (2008). Students and staff are responsible for 3G data costs: either on prepay ($1 per day for a limit of 10MB 3G data) or a data plan (e.g. 200MB $39/month or 1GB $59/month mobile broadband account) plus any voice and txt account (Prepay or on plan). Internet connectivity will also be available via Unitec's WiFi network while on campus. This provides faster, free web access while on campus. Unitec will also provide a free SMS service for course related communication and announcements via Moodle or Blackboard.

Based on the experiences gathered from eight mobile learning trials over the last three years (Cochrane, 2005; 2006; 2007; 2008) the researcher has short-listed several pedagogical critical success factors. Several of these are also corroborated by the 'nine critical success factors' of authentic learning (A. Herrington & Herrington, 2007; 2006).

1. The level of pedagogical integration of the technology into the course criteria and assessment.
2. The level of lecturer modelling of the pedagogical use of the tools.
3. The use of regular formative feedback from both Lecturers and student peers.
4. Appropriate choice of mobile devices and software.
5. Technological and pedagogical support.

Therefore the integration of the mobile web 2.0 technologies into lecturers' daily workflow and integration into course activities and assessment are critical success factors, as is the establishment of a collaborative learning environment. Course lecturers are encouraged to create a learning environment where regular formative feedback is posted as lecturer comments on students' blogs, and to use instant messaging and microblogging to be able to respond to students' questions whenever they are available online (as well as in the classroom). Appropriate assessment activities will be developed, and a detailed survey of the key mobile device affordances will be undertaken for each specific context (student group and course context) to determine the most appropriate smartphone for each group.

The project will be guided and supported by weekly "technology sessions" (Community of Practice) facilitated by a 'technology steward' (Wenger *et al.*, 2005) investigating the potential of mobile web 2.0 technologies for integration within each course. Taking some broad framework ideas from the recent Wollongong mlearning projects (J. Herrington *et al.*, 2008), lecturers participating in the projects will be required to fulfil several commitments (as below), and the projects will be rolled out over two semesters: beginning with the continuation and expansion of established projects in semester one, (which will be used as example champions) with new projects focusing initially on lecturer professional development during semester one, followed by student implementation in semester two of 2009 as outlined in Table1 below..

Participant (Lecturers) requirements:

1. Participation in a weekly Community of Practice.
2. Personalised integration of mobile web 2.0 technologies.
3. Development of mlearning activities based on social constructivist pedagogy for implementation with students.
4. Implement a semester-long mlearning project with students.
5. Publish a research output based on the project, e.g. a study paper at a conference, or in a journal, or presentation at a symposium to other staff.
6. Ethics consent for researchers' anonymous use of data.

Deliverable	Timeframe	Outcome
mLearning projects with Bachelor Product Design (4 staff, 54 students)	Semester 1 2009	mLearning champions, present staff stories at mini symposium mid semester1
Establish weekly COP with (8-10) lecturers from Faculty of Creative Industries. Establish support requirements (with ITSC and Vodafone)	Second half Semester 1 2009	Staff develop competency with mlearning. Staff develop pedagogical mlearning activities based on social constructivist pedagogies
mLearning projects with staff and students from Faculty of Creative Studies (8-10 staff, 150 students). Implementation of the mlearning activities within each course and assessment.	Second Semester 2009	Increased student engagement. Flexible delivery. Facilitating social constructivist pedagogies and bridging learning contexts.
Staff publish and present case studies based on project implementation	End of Semester 2 2009 and Semester 1 2010	Conference, Journal publications and symposia presentations
Institutional strategy	2010	A new approach to enabling learning and teaching.

Table 1. Mobile Project Timeframe.

The core activity of the project is the creation and maintenance of a reflective blog as part of a course group project. However the smartphone can be used to enhance almost any aspect of the course, and was illustrated by the range of activities used in the 2007/2008 projects. Several affordances of the new generation of smartphones will be focused on in the 2008 projects as shown below in Table 2. These affordances will facilitate formative lecturer and peer feedback during the projects. The included URLs reference the Educause "7 reasons" series of articles (http://connect.educause.edu/Library/ELI/7ThingsYouShouldKnowAbout/), providing an educational perspective on the importance of these emerging technologies.

Activity	Overview	Examples	Pedagogy
Video Streaming	Record and share live events	Flixwagon, Qik http://www.qik.com	Real-time Event, data and resource capturing and collaboration.
Geo tagging	Geo-tag original photos, geolocate events on Google Maps	Flickr, Twitter, Google Maps http://tinyurl.com/5a85yh	Enable rich data sharing.
Micro-blogging	Post short updates and collaborate using micro-blogging services	Twitter http://tinyurl.com/2j5sz3	Asynchronous communication, collaboration and support.
Txt notifications	Course notices and support	Txttools plugin for Moodle and Blackboard	Scaffolding, learning and administrative support
Direct screen sharing	Video out to video projector, pico projector or large screen TV	Microvision Show http://tinyurl.com/celgot	Student presentations, peer and lecturer critique.
Social Networking	Collaborate in groups using social networking tools	Vox groups, Ning, peer and lecturer comments on Blog and media posts http://tinyurl.com/4uz6rj	Formative peer and lecturer feedback.

Table 2. Affordances of smartphones mapped to social constructivist activities.

Smartphone Evaluation Rubric:

One of the identified critical success factors is the appropriate choice of technology, including the mobile device used, in each different context. In order to facilitate this, a simple rubric has been created for comparative rating of several current and soon to be available smartphones according to their match with sixteen affordances for mlearning and mobile web 2.0. An example rubric evaluation is given below in Tables 3 and 4. This uses a rating via 'unweighted' affordances – i.e. for some projects particular affordances will be more important than others, and therefore should be given higher than equal rating factors. The ranking of affordances (0 to 3) is of course relatively subjective, but is based on the experiences of previous projects.

Affordances (Ranked 0 (NA), 1 poor, 2 good, 3 excellent):

1. Image capture
2. Video capture
3. Video streaming
4. Mobile Web
5. Text entry for mobile blogging and email
6. GPS for geotagging and geolocation services
7. Touch screen for ease of navigation
8. Third party applications
9. Ease of use (User Interface)
10. 3G Data connection speed
11. WiFi for free internet access at Unitec
12. Cost of the device
13. Current availability of device in New Zealand
14. Screen size
15. Screen and video out for connection to TV or projector
16. Portability (Size, weight, is a separate folding bluetooth keyboard required?)

	Smartphone								
Affordance	**iPhone**	**G1**	**Palm Pre**	**N97**	**E90**	**N95 + kbd**	**5800 XM**	**P1i**	**C905 + kbd**
1. Image capture	1	2	2	3	2	3	2	2	3
2. Video capture	1	0	2	3	3	3	3	1	1
3. Video streaming	1	0	2	3	3	3	3	1	1
4. Mobile Web	3	3	3	2	2	1	2	1	1
5. Text entry	3	2	3	3	3	3	2	2	2
6. GPS	3	3	3	3	3	2	2	0	3
7. Touch screen	3	2	3	3	0	0	2	2	0
8. Apps	3	2	2	2	3	3	2	1	1
9. UI	3	2	3	2	2	2	2	1	3
10. 3G	3	3	3	3	3	3	3	1	3
11. WiFi	3	3	3	3	3	3	3	3	3
12. Cost	2	1	2	1	1	3	2	3	2
13. Availability	3	1	0	0	3	3	1	3	3
14. Screen size	3	3	3	3	3	1	3	1	1
15. Video Out	2	3	3	3	0	3	3	0	3
16. Portability	3	2	2	2	1	1	3	3	3
Score	**40**	**32**	**39**	**39**	**35**	**37**	**38**	**25**	**33**

Table 3. Rubric for ranking the affordances of example smartphones for mobile web 2.0.

Smartphone	**Affordance Rank**	**Advantages**	**Disadvantages**
Apple iPhone	40	UI, Web2, apps	Jailbreak, camera
Nokia N97	39	Specs, all-in-one, vid out	Cost, unavailable
Palm Pre	39	UI, Web2	Unavailable, Cost? Apps?
Nokia 5800XM	38	Size, Cost, all-rounder, vid out	Camera, plastic
Nokia N95 + kbd	37	Cost, vid out, apps	Screen, ext KBD
Nokia E90	35	Screen, built-in kbd, apps	Size, non touch, no vid out, limited Multimedia
Sony Ericsson C905	33	Vid out, simplicity, still camera	Non smartphone, no KBD, non touch, screen size
Google G1	32	Google integration, OS	Cost, apps, no vid record yet
Sony Ericsson P1i	25	Cost, handwriting	UI, no vid out, screen size, UMTS

Table 4. Strengths and weaknesses of a range of smartphones.

The Nokia N97 and Palm Pre would both rank higher than the iPhone if they were currently available in New Zealand. Windows Mobile and Blackberry devices are excluded by choice. The researcher is interested in devices that students will want to own and use, rather than 'business' focused devices. Additionally, the smartphone market is dominated by Nokia, followed by Sony Ericsson, Apple, Samsung, Motorola, with various Windows Mobile devices accounting for approximately 14% of the smartphone market.

2009 Mobile Project Outlines:

Twelve mobile web 2.0 projects are planned for 2009, involving a range of disciplines, levels, and learning contexts. Below (Table 5 & 6) are outlines of two indicative mobile projects.

Course: Bachelor of Product Design, third year class	
Participants	• 24 students • 2 Course Lecturers • Technology Steward (Thom Cochrane – CTLI)
Mobile Technology	Nokia N95 WiFi smartphone (to be upgraded to N97 in Semester 2), Bluetooth folding keyboard, participants responsible for 3G data, voice & txt.
Pedagogical Focus	The third year course is based around a Studio Design model where students undertake three design projects throughout the year, one of which is substantial. The project involves documenting the research and design of these products throughout the year, including working with a client company in small design teams. The first project is a collaborative project with UATI and Landscape Design students. The mobile web 2.0 technology will also be used to establish a weekly 'nomadic' studio session with staff and students focusing on context bridging and full integration of moblogging into course projects.

Community of Practice	Weekly throughout the entire course
Support LMS	Moodle
Deliverables	An assessed online Blog/eportfolio documenting and showcasing students' design processes and forming the basis of a collaborative hub with worldwide peers and potential employers/clients. And the weekly use of instant messaging, microblogging, and VODCasts during the 'nomadic' studio session.
Timeframe	March 2009 through to November 2009.

Table 5. Outline of BDesign Third Year mobile project.

Course: Bachelor of Performing and Screen Arts	
Participants	• 60 to 70 students • 4 Course Lecturers • Technology Steward (Thom Cochrane – CTLI)
Mobile Technology	Nokia XpressMusic 5800 WiFi smartphone (or similar), participants responsible for 3G data, voice and txt.
Pedagogical Focus	TBD – e.g. Students capture, critique and share performances. Students investigate the current and future uses of web 2.0 technologies in performing arts production and distribution. Students research and report on various technologies using a weekly podcast/vodcast that is peer critiqued by students on a similar course at a different institution.
Community of Practice	Weekly throughout the entire course
Support LMS	Blackboard
Deliverables	An assessed online Blog/eportfolio documenting and showcasing students' design processes and forming the basis of a collaborative hub with worldwide peers and potential employers/clients. And the weekly use of instant messaging, microblogging, and VODCasts for communication and collaboration.
Timeframe	March 2009 through to July 2009 with Lecturers. Student projects begin Semester2 2009.

Table 6. Outline of SPASA mobile project.

CONCLUSIONS

This paper presents the exciting evolution of mobile web 2.0 projects from small pilots to a large-scale roll-out based on an emergent implementation model. The variety of discipline and learning contexts involved illustrate the potential of this implementation model to be used widely in tertiary education that is underpinned by a social constructivist pedagogy, and bridges the formal and informal learning contexts. Results of these projects will be evaluated and reported at the end of 2009.

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Characteristics of Pervasive Learning Environments in Museum Contexts

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ABSTRACT
There is no appropriate learning model for pervasive learning environments (PLEs), and museums maintain authenticity at the cost of unmarked information. To address these problems, we present the LieksaMyst PLE developed for Pielinen Museum and we derive a set of characteristics that an effective PLE should meet and which form the basis of a new learning model currently under development. We discuss how the characteristics are addressed in LieksaMyst and present an evaluation of the game component of LieksaMyst. Results indicate that, while some usability issues remain to be resolved, the game was received well by the participants enabling them to immerse themselves in the story and to interact effectively with its virtual characters.

Author Keywords
Pervasive learning environment, museum learning, learning model, pervasive game, mobile learning

INTRODUCTION AND BACKGROUND

Museums are rich repositories of information to be shared with visitors. This information can often remain partially hidden despite the efforts of curators in designing cues, labels and tours. This is also the case in the Pielinen Museum, which is the second largest outdoor museum in Finland. It is renowned for its authentic atmosphere, and as such most exhibits have been left intentionally without tags, labels and information boards. The challenge of conveying the hidden stories of objects and of the past lives is tackled by an innovative pervasive learning environment (PLE), LieksaMyst, which consists of a set of learning tools including, for example, an intriguing, story-based pervasive mobile game. In the process of designing and implementing the system, we derived a set of characteristics that effective PLEs for museums should conform to. In this paper we present the background to our work, the LieksaMyst PLE, the set of characteristics, and an initial evaluation of the PLE based on the feedback from a group of learners using LieksaMyst's pervasive mobile game component.

Pervasive Learning Environments

Firstly, we make a distinction between the terms *pervasive* and *ubiquitous*, which are often used inconsistently and interchangeably. Lyytinen and Yoo (2002) have proposed a division of different learning types along the axes of embeddedness and mobility (Figure 1), according to which, *pervasive* implies less mobility than *ubiquitous*. However, we do not see it only as a matter of place – pervasive learning also relates to time and activity, hence a pervasive learning experience is bound to vary according to place, time and a learner's activity. Despite the differences at the conceptual level, the same technologies (e.g. mobile devices, sensors, smart tags) can be applied to both ubiquitous and pervasive learning.

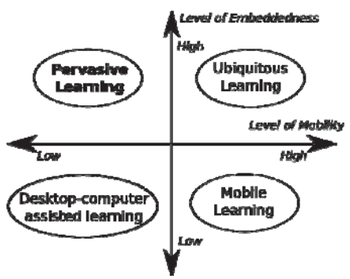

Figure 1. Types of learning according to levels of mobility and embeddedness (Lyytinen and Yoo, 2002)

From another perspective, pervasive learning can be considered as an extension to m-learning with an emphasis on the roles of an intelligent environment and context. The physical environment is central, as it provides salient resources for learning (e.g. museum objects). According to Syvänen *et al.* (2005), a *pervasive learning environment* (PLE) is a setting in which students can become totally immersed in the learning process. They further note that pervasive computing is an immersive experience which mediates between the learner's mental (e.g. needs, preferences, prior knowledge), physical (e.g. objects, other learners) and virtual (e.g. content accessible with mobile devices, artefacts) contexts, and the intersection of these contexts is the pervasive learning environment. Syukur and Loke (2007) regard a pervasive learning environment as a collection of mobile users, mobile services, mobile devices, contexts and policies, while Ogata *et al.* (2006) state that in pervasive learning, computers can obtain information about the context of learning from the learning environment in which embedded small devices, such as sensors, pads and badges, communicate together. Common factors in these definitions include the interplay of intelligent technology and the context in which the learner is situated (i.e. context-awareness).

Currently there is a lack of a theoretical learning model on which effective pervasive learning environments can be built (Laine and Joy, 2008). In this paper we establish foundations for such a model by deriving a set of key characteristics of pervasive learning environments for museums.

Learning in Museums

There are many reasons why people visit museums. For some it is a leisure activity, while others may come together with a school group. Most visitors come to museums in order to learn something new or to continue refining and refreshing the knowledge gained from previous visits. Children and young adults can be an exception, as their motivation for the visit can be the authority of school and not their own choice. Just as there are many reasons for visiting museums, there also exist reasons for *not* visiting them. One particularly strong reason is a negative attitude towards museums which only increases the unwillingness for free-choice visits (Black, 2005). Therefore it is important to work towards improving and maintaining positive attitudes of potential visitors towards museums.

The type of learning that takes place in museums is a hybrid or continuum between informal and formal, and the degree of (in)formality depends on the purpose of the visit. For example, a school group may have a slightly more formal learning agenda than a senior couple. Furthermore, a school group's visit to museum is often connected to more formal learning that takes place in an ordinary classroom environment.

In addition to why people visit museums, we should also consider how the visits should be organized in order for them to be effective in terms of learning. There are two basic visit types: free and guided. It has been suggested that neither of the extremes is optimal for learning, but that we should choose something in between instead (Bitgood, 1989; Linn, 1980). Indeed, it has been suggested that curators and guides have a tendency to communicate unidirectionally (Durbin, 2004) which reminds us of the behaviorist monologues familiar from formal classroom environments. For first-time visitors it may be beneficial to run an orientation program prior to the visit (e.g. teacher tells children about the museum before the visit). Orientation can also be facilitated with cues which guide an (unguided) visitor (Rennie and McClafferty, 1995). Finally, visitors should not be voiceless in the museums but they should rather be encouraged to interact with the environment (Hall and Bannon, 2005) and with each other.

There exists substantial evidence on positive outcomes related to museum visits. For example, Falk and Balling (1979) reported the development of positive attitudes and cognitive learning; Koran and Koran (1986) suggested that a museum visit is an interesting experience which raises curiosity, affects psychomotor development, interest, appreciation, motivation, and generalization; and Wolins *et al.* (1992) reported affective/emotional experiences. These outcomes relate to all three dimensions of learning in Bloom's taxonomy: cognitive (knowledge), affective (attitude), and psychomotor (skills). These are also emphasized in the evaluation of Hooper-Greenhill *et al.* (2003) which concluded that museums, archives and libraries impact learning in the following dimensions: (1) increase in knowledge and understanding (cognitive); (2) increase in skills (psychomotor); (3) change in attitudes and values (affective); (4) evidence of enjoyment, inspiration and creativity (motivational); and (5) evidence of activity, behavior, progression (conative). Given this support for a variety of learning types, museums are a useful context for investigating a wide range of learning activities from theory to practice.

Mobile and Wireless Technologies in Museums

Using technology in museums is not a new phenomenon as various technologies have been utilized over forty years – from reel-to-reel tapes to cassettes, and from digital players to mobile devices (Proctor and Tellis, 2003). Our focus is on mobile and wireless technologies, as they are key elements of pervasive learning environments. Typically mobile devices are either PDAs or mobile phones, but Ultra Mobile PCs and Tablet PCs are also used. In the future we also expect to see more wireless *netbooks* (small and inexpensive laptops).

In addition to mobile device portability, personality, intuitiveness, and ubiquitousness, pervasive learning environments should also support location- and context-sensitiveness. Context-sensitive mobile-based systems have been used in museums and science centers before, including Xsplot (Hsi and Fait, 2005); Via Mineralia (Heumer *et al*., 2007); Tate Modern's Multimedia guide (Proctor and Burton, 2003); and the MOBIlearn application in Nottingham Castle Museum gallery (Lonsdale *et al*., 2005). Existing systems often utilize RFID or other smart tagging to implement context-sensitiveness. Positioning technologies (e.g. WLAN positioning, GPS) have also been used to make the system aware of the user's location (e.g. Wang *et al*., 2005).

PERVASIVE LEARNING ENVIRONMENT FOR A LIVING MUSEUM

Pielinen Museum

Pielinen Museum in Lieksa is the second largest open air museum in Finland, hosting over 70 old buildings and structures containing over 100,000 objects from different periods of time. Pielinen Museum is a *living museum*, as it depicts how life used to be in Eastern Finland in the past. In 2007 and 2008 the museum attracted 8968 and 8692 visitors respectively. Figure 2 shows the Virsuvaara house exterior and interior, where our work has so far been concentrated.

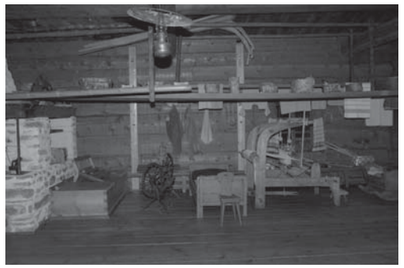

Figure 2. House exterior (left) and interior (right) – the right half was used in the first experiments.

Authenticity is one of the strengths of Pielinen Museum and in order to keep the atmosphere authentic the buildings, structures, and objects have not been equipped with tags and labels. Until now, the only way to know more about the objects and buildings has been through guided tours, where information has been mostly unidirectional and schedules of tours have not always been convenient. We sought a solution to these challenges in user-centered design workshops with museum visitors during summer 2008 before implementing the LieksaMyst pervasive learning environment described below. Workshop attendees wished to know more about life in specific periods of time, and how particular items were used and connected to other items. Some attendees also suggested that it would be interesting to hear authentic sounds (e.g. old master's snoring). A deeper analysis of the workshop data will be presented elsewhere.

LieksaMyst

LieksaMyst is the name for a pervasive learning environment (PLE) that we have developed in the Pielinen Museum together with a group of museum visitors and the curators of the museum. Rather than merely replacing the human guides, LieksaMyst offers possibilities for versatile interaction with the museum environment. LieksaMyst's core is a story-based role-playing game which takes the learner back in time to meet people who lived in the old houses and used the authentic objects for various activities. Together with these authentic albeit fictional characters, the learner experiences daily routines of the respective period of time. Interaction between the learner and the fictional character is done through the mobile device and the system supports text, images, sound, and video. One game session can last from 20 minutes to several hours, depending on how much content is available and how motivated the learner is.

Currently we have created a story for one character living in one of the largest buildings in the museum, Virsuvaara. The character is Anna, the 40 year-old lady of the Virsuvaara house. She lives together with her husband, children, grandparents, servants, and lodgers, in total 18 persons in a single room. Among her daily activities Anna tells and shows the learner for example how butter is churned, how carpets are made, and what kind of food was eaten in her house in 1895. The learner is also presented with various challenges ranging from intriguing queries to finding a specific object needed to complete an activity. These challenges are part of the interaction with Anna – she requests the learner's help in order to complete her daily chores. Object recognition is currently performed manually by typing in a short numeric code that is carved on an authentic-looking wood piece next to the respective object.

The learner is given the chance to select from various alternative story branches. At the end of the day as Anna wishes farewell, she prompts the learner to sign her guest book. This entry, together with the learning experience (story path) of the learner is stored on the server so that it can be presented later, for example on the homepage of the game for reflection purposes. In terms of social interactions in the game, learning situations often involve several learners using a single mobile device and several groups exchanging ideas with each other without explicit encouragement.

In addition to the role-playing game, LieksaMyst also has other learning tools available. Currently we have implemented a database discovery tool which allows context-sensitive access to pictures and text located in the museum database. We are also currently creating a learning tool through which the learner can retrieve context-sensitive information about any object and its usage via RFID tags. Rather than mere information retrieval, this tool will also allow recording of related evidence and posting comments in the form of text, pictures, voice, and video. Additionally, in the near future we will release an easy-to-use editor tool for curators to create and edit content for LieksaMyst.

CHARACTERISTICS OF PERVASIVE LEARNING ENVIRONMENTS

Currently there is no learning model established and tested to support the design and construction of PLEs (Laine and Joy, 2008). As the first step towards building such a model, we have derived a set of characteristics based on inherently constructivist principles of situated learning, authentic learning, contextual learning, group-based learning, exploratory learning, problem-based learning, and museum learning. We chose a hybrid approach as none of the existing models would alone suit PLEs for museums. Table 1 presents these characteristics together with references to supporting literature, rationale for inclusion, and analysis on how each characteristic has been implemented in the LieksaMyst PLE. The characteristics (15) have been organized into five categories: User profile and perspectives; Interaction and collaboration; Ownership; Authenticity and relevance; and Support and assessment.

Characteristic	Supporting literature	Rationale	In LieksaMyst
User profile and perspectives			
Multiple roles, perspectives and skill levels	Hall and Bannon, 2005; Kelly, 2002; Herrington and Oliver, 2000; Herrington *et al.*, 2003; Thomas, 2005; Falk and Dierking, 2000; Johnson and Quin, 2004; Csikszentmihalyi and Hermanson, 1995	In order to support visitors of various backgrounds, skills and interests, the PLE should provide access to various roles, perspectives and skill levels in an adaptive manner.	Multiple roles are provided through various fictional characters and activities performed with them. As each fictional character can have several stories to share, it is possible to create a hierarchy of skill levels. Alternative learning tools offer possibilities for those who do not enjoy gaming.
Consideration of background, prior knowledge and experiences	Scanlon *et al.*, 2005; Kelly, 2002; Falk and Dierking, 2000; Schmidt, 1983; Sharples, 2003	Prior knowledge and experiences should be taken into account in learning activities. For example, a first-time visitor has different needs from a regular customer who visits the museum frequently.	Learners' prior experiences are currently considered through free choice of characters and stories that are based on feedback from design workshops. We are also planning to include personal profiles for learners who visit the museum often.
Interaction and collaboration			
Social negotiation and collaboration	Scanlon *et al.*, 2005; Hall and Bennon, 2005; Kelly, 2002; Csikszentmihalyi and Hermanson, 1995; Herrington and Oliver, 2000; Herrington *et al.*, 2003; Mims, 2003; Falk and Dierking, 2000; Savery and Duffy, 1994; Thomas, 2005; Sharples, 2003; Hein, 1990	Sharing experiences and facing challenges together facilitates effective learning.	Learners have the possibility to play together using the same device or interact with each other in a shared physical space. More collaborative activities are under development.
Multimodal exploration of the environment and objects	Mims, 2003; Johnson and Quin, 2004; Csikszentmihalyi and Hermanson, 1995	By exploring the environment through various senses the visitor becomes more attached to it.	The game encourages the learner to explore the environment through story-telling and various activities. Both visual and aural modalities are currently used. Some players also reported “old scent”.
Ownership			
Ownership of the learning process and outcome	Kelly, 2002; Csikszentmihalyi and Hermanson, 1995; Mims, 2003; Herrington *et al.*, 2003; Falk and Dierking, 2000; Savery and Duffy, 1994; Thomas, 2005; Sharples, 2003; Johnson and Quin, 2004; Hawkey, 2001; Hein, 1990	Ownership directly affects motivation to learn. Furthermore, having control over one's own learning process is necessary for effective learning.	The learner is in control of the story in terms of pace and choices made (story branches). Learning paths and any recorded “evidence” are owned by the learner.
Ownership of the technology	Scanlon *et al.*, 2005; Thomas, 2005; Sharples, 2000;	In addition to increased motivation, owning the technology has direct consequences on the ability to use the technology effectively.	Although in the testing phase a set of the museum's mobile devices are used, in the future the learners can use their own devices as the mobile technology is general and portable.

Authenticity and relevance			
Authentic context	Herrington and Oliver, 2000; Schmidt, 1983; Grabinger *et al.*, 1997; Falk and Dierking, 2000	Solving real world challenges cannot be taught effectively in an unauthentic setting. Authentic context is also important for deep immersion of the learner.	Exhibits in the Museum of Pielinen are in a very authentic state due to local preservation policy. The look and even the smell of old objects seem authentic.
Authentic activities that have relevance to the real world	Scanlon *et al.*, 2005; Kelly, 2002; Herrington and Oliver, 2000; Herrington *et al.*, 2003; Mims, 2003; Savery and Duffy, 1994	Connecting learning activities to the real world is an important part of making the meaning of concepts. Without real world relevance, the concepts remain abstract.	Activities have been designed to be authentic with curators who possess expert knowledge on local history and old traditions. Real world relevance stems from the relation of the activities to the modern life of the visitors.
Compelling narrative to facilitate immersion	Hall and Bennon, 2005; Falk and Dierking, 2000	The PLE should employ a compelling narrative that helps the visitor to immerse quickly into the authentic context.	Stories are compelling and interaction with authentic characters helps in the immersion process.
Gained experiences integrated and applied across different subject areas	Herrington *et al.*, 2003; Mims, 2003; Sheppard, 2001; Hooper-Greenhill *et al.*, 2003	Knowledge can and should be transferred across disciplines. The PLE should allow generalization and linkage of the knowledge to other contexts and subject areas.	Due to the nature of the museum (living museum), the knowledge can be easily transferred to other "living contexts" for reflection and comparison. Furthermore, stories may have intersecting aspects for making connections.
Personal relevance	Scanlon *et al.*, 2005; Mims, 2003; Grabinger *et al.*, 1997; Thomas, 2005; Falk and Dierking, 2000	Learning activities in the PLE should have personal relevance, so the learner is able to construct a personal meaning of a concept.	Learners can relate learning activities performed with authentic characters to equivalent activities in their own lives, hence the personal relevance.
Support and assessment			
Scaffolding techniques	Hall and Bannon, 2005; Kelly, 2002; Csikszentmihalyi and Hermanson, 1995; Herrington and Oliver, 2000; Mims, 2003; Savery and Duffy, 1994	Support should be available when the learner needs it the most, and it should be faded out when the learner can face the challenges themselves.	Scaffolding is something that could be improved. Currently, authentic characters and guides give hints and suggestions to the learner but the learner's skill level is not measured so as to adapt the given help.
Support for reflection	Rennie and McClafferty, 1995; Kelly, 2002; Herrington and Oliver, 2000; Herrington *et al.*, 2003; Falk and Dierking, 2000; Savery and Duffy, 1994; Johnson and Quin, 2004	The PLE should offer possibilities for reflection during and after the museum visit. During reflection new knowledge is linked to existing mental models and prepared for future linkages.	Currently post-reflection activities are not explicitly supported, but in the near future a website will be launched which presents stored learning experiences for further reflection and commenting.
Immediate feedback	Csikszentmihalyi and Hermanson, 1995	Immediate feedback is necessary to promote reflection and maintain intrinsic motivation.	The learner is provided with immediate, choice-dependent feedback after each activity.
Integrated, authentic assessment if applicable	Herrington and Oliver, 2000; Herrington *et al.*, 2003	Sometimes assessment is wanted. In such cases the PLE should offer a possibility to perform assessment integral to the learning process.	The application is not being used for assessment purposes as we aim to raise intrinsic motivation rather than extrinsic. However, there is a currently disabled feature that counts points for players according to their performance.

Table 1. Characteristics of pervasive learning environments for museums

EVALUATION AND DISCUSSION

As evaluation we present part of the results of experiments conducted in the Pielinen Museum during November-December 2008. Participants used only the role-playing part of the game – the database discovery tool was not part of the agenda although some players voluntarily explored it. These results show the first impressions and attitudes of the players, and represent only a subset of the entire study.

Test scenario

In total 49 test participants were included in this test. Participants were of various nationalities: Finnish(31), Polish(4), Korean(4), Nepalese(2), Russian(2), German(1), Chinese(1), Pakistani(1), Latvian(1), Czech(1), and South African(1). The game had two language versions (Finnish and English). Testing was conducted in the Virsuvaara house from the 19th century, which is one of the largest buildings in the museum. For the experiment we designed a two-part questionnaire – the first part to be filled before playing (demographics, previous mobile usage, attitudes, media preferences) and the second part after playing (after-game experiences, perceptions). Observations of the participants were also recorded.

We ran four test scenarios with different groups: (1) a group of local children from 7th grade; (2) a group of local senior teachers; (3) a group of foreign exchange students; and (4) museum staff and visitors from South Korea. The first three groups were selected to represent different ages and cultural backgrounds, and the last group was used as to receive the museum staff's perceptions as well as more international perspectives. Before participants were taken to the test location, they were given a short presentation on the museum and on our educational technology research in general. After the presentation the first part of the questionnaire was filled out, followed by the actual game play in Virsuvaara. The amount of time spent for playing varied from approximately 15 minutes to 45 minutes, and participants were either playing individually, in groups of two (most cases), or in groups of three. After the game play the participants were asked to fill in the second part of the questionnaire. Nokia N95 and N80 phone models were used in tests.

For the first test group (local 7th graders) we (accidentally) did not remove object codes from the user interface, as we used these codes for internal testing previously, hence locating objects was not a challenge for the participants. This was the major complaint heard in the questionnaires of the first group. Some players in other groups also noticed that the codes are in sequential order, thus guessing the next code was easy.

Evaluation results and discussion

The average ages of males (49%) and females (51%) were 28.73 and 30.28, respectively. All test participants owned mobile devices, even the school children, thus penetration of wireless communications amongst them was very high.

In the pre-test questionnaire we asked for participants' perceptions of museums in general. We compared these answers with the answers to a question which measured participants' perceptions towards the test day experience in Pielinen museum in the post-test questionnaire. In the pre-test questionnaire the statement was "In general, I think museums are:" and the answer options with respective results were: *Boring* (4.1%), *Interesting* (75.5%), *Exciting* (20.4%), *Unexciting* (2%), *I have no opinion about them* (6.1%), and *Other* (4.1%). The two participants who answered *Other* gave further explanations as *Interesting* and *Something*. In the post-test questionnaire equivalent statement was: "I think today's visit at Pielinen Museum was:" and the answer options with respective results were: *Boring* (6.1%), *Interesting* (89.8%), and *Other* (14.3%). *Other* answers were amended only with positive comments such as "exciting," "quite ok," "interesting and enjoyable," "wonderful," and "really, really nice and interesting." Those who answered *Boring* were from the first test group and it is possible that the presence of object codes in the user interface affected their experience. The sum of percentages in these answers exceeds 100% as some participants checked (against instructions) more than 1 option.

We also asked in the post-test questionnaire if the participants would be happy to come back to Pielinen museum (91.8%) or if they would not be interested in coming back anymore (8.2%). From four who were not interested in coming back, three were from the first test group and one from the exchange student group. In order to discover participants' perception of LieksaMyst, we presented them two statements with scale Strongly Agree (SA) – Agree (A) – Disagree (D) - Strongly Disagree (SD) with weights 1, 2, 3 and 4, respectively. The questions and the respective answers are presented in Table 2 together with average and standard deviation values. Sum of the percentages on the first statement exceeds one hundred as one of the participants answered both D and SD.

Statement	***SA(1)***	***A(2)***	***D(3)***	***SD(4)***	***Avg***	***StDev***
I think I would like to try the game again here next summer.	44.9%	44.9%	8.2%	4.1%	1.68	0.74
I think I would like to try the game also in another museum.	40.8%	53.1%	4.1%	2%	1.67	0.66

Table 2. Participants' perceptions of LieksaMyst

Analysis of these tests regarding pre- and post-conceptions of museum visits and the game reveal that a good majority of the participants considered museums exciting and interesting places before trying the game. This could be due to the fact that the participants came to test the application in the museum voluntarily, thus they might be representative of the general population that prefer museums. After playing the game, the visitors' conception of the visit was very positive and a strong majority expressed their willingness to return to the museum and try out the game again in Pielinen Museum and other locations as well. We consider this a strong indication that the game was well received by the audience.

Finally, we asked the participants open questions about their likes and dislikes about the game. Table 3 presents the most common and interesting answers. Where applicable, we have included in parentheses references to the characteristics presented in Table 1. This was an interesting result as we did not explicitly relate the questionnaire to the table of characteristics and these aspects were articulated by the participants. Usability issues were reported mostly by the group of senior teachers, thus there is a clear need to improve the game to fit all ages. These results suggest that we should improve image quality, screen size, add audio narration, and provide other tools in addition to the game to explore the museum, as not everybody favors games.

What did you like/enjoy about playing with Anna?	***What did you dislike or find difficult about playing with Anna?***
I could find out new things. Anna's intermediate comments were good, Male 13. (Immediate feedback)	Difficult to see the numbers [because of dark room], for me a little bit too much story telling, Male 26. (Multiple perspectives, skill levels)
I was feeling as if I was helping her and knowing things like making coffee, butter and know about the Finnish fire place, Male 24. (Authentic context, activities, and immersive story)	Pictures are not reproduced well enough due to small screen size of the client device, Male 55. Character keys are too small so I made errors unintentionally, Female 75.
The nice thing was that it was possible to get information through playing and action. It was nice to kind of discuss with Anna, Female 30. (Immersive story)	Most of conversations are just text. I think sometimes it should be better [if] the text will be explained on voice, Male 29. (Multimodal exploration)
Getting to know how Anna's typical day looked like, Female 23. (Authentic activities)	That the object numbers were already visible, Male 13.
It was a good simulation and I felt as if I was actually involved in the situation, Male 22. (Authentic context, activities and immersive story)	Before playing with Anna, it would have been better if I had an introductory guided tour about the house, Male 46. (Prior experiences)
I liked it when I had to start searching for objects, Female 13. (Multimodal exploration)	Anna's comments were sometimes annoying, Female 13. (Multiple perspectives, skill levels)
I could control the pace of game; I got to know how those old objects were used in the 19th century, Female 21. (Learner's control)	Few questions which were quite interesting but being a non-Finnish I found them difficult, Male 22. (Consideration of prior knowledge, background)

Table 3. Participants' likes and dislikes regarding playing with Anna

CONCLUSIONS

LieksaMyst PLE solves the problem of unmarked objects and information in the Pielinen Museum. At the same time, the museum visit becomes more exciting and engaging, thus having a potentially positive effect on visitors' attitudes towards museums. As the system was developed together with museum visitors and curators, the end result was highly compelling and met many visitors' expectations. Evaluation showed that the game part of LieksaMyst was well received and its story-based immersive game play would have potential in other museums as well. We concluded also that LieksaMyst met most of the characteristics of pervasive learning environments that we derived based on a large body of literature on existing constructivist learning models and theories.

In the future we will refine LieksaMyst to fully conform to the characteristics of PLEs and test the technology in other locations as well, not limited to museums. We will continue further our efforts to develop a sound learning model for pervasive learning environments that will fill the existing gap and will therefore be the basis of future PLEs.

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Adventures in the Mobile Learning Toolbox

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ABSTRACT
As educators and technologists we have various views on what may constitute a useful mobile learning application, but this is typically from a teacher's perspective. In this paper, we review some mobile learning applications developed by some postgraduate students who were free to explore their own ideas about mobile learning. Reviewing the range of applications developed and the mix of implementation technologies chosen demonstrates that these learners' perspectives go beyond simplistic categorizations of mobile technologies and associated learning applications. Rather, they use a blend of technologies and pedagogical approaches to meet the requirements of each learning context.

Author Keywords
Java Micro Edition, mobile learning applications, student projects

INTRODUCTION
Mobile learning applications vary widely in the technologies that they use and the learning content that they attempt to deliver. Prensky (2005) summarized what technical features could be used for learning on mobile devices, and what types of application these technical features could support (Table 1). Whilst this categorization has some utility in terms of specifying fundamental requirements, it provides a somewhat narrow view of the relationship between a particular technology and a specific type of application.

Technical Feature	Sample Applications
Voice based	Languages, literature, public speaking, writing, storytelling, and history
Short Message Service (SMS) Text Messages	Behavioral reminders, voting, quiz games
Graphical Displays	Animations in subjects such as anatomy and forensics, sign language, mobile manga
Downloadable Programs	Applications combining voice, text, graphics
Internet Browsers	Research tool
Cameras and Video	Data collection, observation, journalism (gathering evidence)
Global Positioning Systems (GPS)	Augmented reality tours, geography

Table 1. Technical features and related mobile learning applications (Prensky, 2005)

In this paper we review a number of mobile learning applications developed by postgraduate students from a course on mobile application development. These students were given the opportunity to develop applications under the general category of 'mobile learning,' but were not constrained in terms of the types of applications they developed. This provided an opportunity to find out what these learners considered to be useful mobile learning systems. Given that the software platform taught in the course was Java Micro Edition, students were given the option of developing either thick client or smart client applications (a thick client does not require external connectivity to function, whereas a smart client requires some form of connection, which may use SMS, the web, Bluetooth or some other communication channel). A number of application areas were available to be explored by the students, so those who developed applications in the mobile learning area chose to do so. The purpose of this paper is to somewhat informally review a representative sample of the students' work to see if we might learn anything from their perceptions of mobile learning applications. It should be noted that the applications presented here were at the proof of concept stage rather than being fully developed, so it was not possible to perform user evaluations of the applications. Rather, we attempt to summarise and categorise their features and concepts in the context of the technology to application mapping described in Table 1. Although the applications here are described in the voice of the researcher, it should be noted that most of the motivations and concepts referred to were drawn from the students' own project reports. The students concerned are individually credited in the acknowledgements section and have given permission for their work to be featured in this paper.

THE MOBILE LEARNING APPLICATIONS

In this section we describe a representative sample of the students' mobile learning applications, generally categorised under the headings of quizzes, games and puzzles, and contextual learning.

Quizzes

Quizzes are popular components of learning systems, which can help the learner to improve their personal knowledge and problem solving ability (Yokomoto, 2000). These may of course address many different types of learning. One such quiz is the 'World Geo-Quiz' which asks geography questions at varying levels of granularity and difficulty (Figure 1). This system takes advantage of the graphics processing abilities of the Java client to display a range of map types at various zoom levels. After the user gives their answer, the country's flag along with further information about it are displayed, thus giving two levels to the activity, both testing existing knowledge and providing the opportunity for further learning.

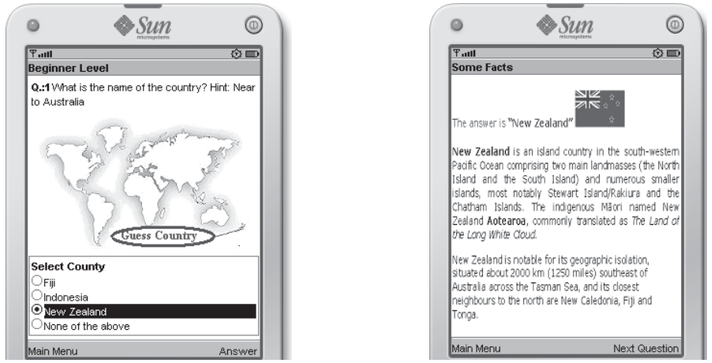

Figure 1. The mobile geography quiz system

Another application that might be categorized under the 'quiz' heading, though with a somewhat different intent, was of note because of the chosen context. The university makes previous exam papers available to students via the library web site, where they can be downloaded as PDF files. However one of the students proposed that these should be converted to mobile format, where they would be both more widely available and (potentially) also self marking. The mobile exam revision system (Figure 2) is simple in concept but has the advantage of obvious utility. The client is a very simple text based system, though smart in the sense that it would need to update its example database regularly via the web (assuming an appropriate server side application).

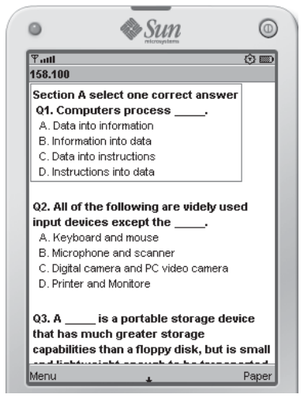

Figure 2. The mobile exam revision system

A common activity for learner drivers is to practice for their theory test in order to gain their driving license. One of the quiz based systems was a mobile version of the New Zealand multiple choice driving theory test. Although the question material is currently available on the web, as well as in print form, the web based version only displays questions and does not support either initial learning or interactive testing and feedback. The mobile system (Figure 3) therefore provides a more functional implementation, as well as providing the benefit of mobility. The system has two modes, learning and testing. The mode can either be selected from the start or can be switched dynamically, e.g. the user can

choose to spend time learning from the system, take a complete test, or learn a feature of the road code and immediately switch to test their learning about that particular aspect of the road code. The overall approach to the design was based on Seong's usability guidelines (Seong, 2006).

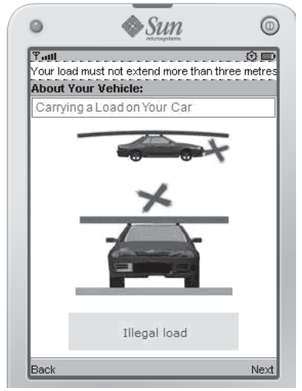

Figure 3. The mobile road code system

Perhaps the key feature of both the past exam paper system and the road code system is that both are addressing relatively urgent goal driven activities, in both cases assisting the learner to prepare for some form of examination. In these situations, having access to revision material any time, any place, with automatic assessment, can be extremely useful.

Games and puzzles

A number of important skills can be developed by using games, including strategic thinking, planning, communication, application of numbers and data handling (Kirriemuir and McFarlane, 2004). However the design of the game needs to take account of structural problem solving, challenging the learner to transfer knowledge, learn about systems, test postulates and communicate effectively (Klopfer, 2008). Two of the students created mobile games based on variants of the classic Space Invaders. In one of these games, players have to solve arithmetic problems before they are able to shoot at the Space Invaders (Figure 4.) The key in this game is solving the mathematical problems quickly enough to be able to shoot enough Space Invaders. There are difficulties trying to teach children new concepts and ideas within a mobile game as they often just focus on the game rather than learning or remembering the content (Agarwal et al., 2008). Therefore this game focuses on reinforcement of skills, rather than new content.

Figure 4. A space invaders variant for practicing high speed mental arithmetic

In the other Space Invaders variant, 'Txt Invaders,' the learning content is based on multiple players sending each other SMS messages containing one or more words (Figure 5). The words score differently depending on their size and the combination of consonants and vowels. Consonants are harder to destroy than vowels because they require two hits rather than one. Thus the construction of the words by the sender controls both the score that the other player can achieve, and the score that the sender will achieve if the other player is unsuccessful. Thus the game incorporates word play (constructing words of a suitable size comprising different balances of consonants and vowels), arithmetic and adaptive strategy.

Unlike the other Space Invaders style game, which was for an individual learner, this game attempts to integrate the social messaging aspect of SMS into an asynchronous game format which permits a degree of pervasive gaming to occur. Pervasive gaming is defined by Montola (2005) as ‘a game that has one or more salient features that expand the contractual magic circle of play socially, spatially or temporally.’ Unlike synchronous multi player gaming, this game exploits the send and reply nature of SMS to encourage extended participation without requiring both players to be playing and connected simultaneously, as is the case in most online games, making it more suitable to the intermittent, context dependant nature of mobile interaction.

Figure 5. TxtInvaders, an asynchronous multi player word and number game

Another of the systems took its inspiration from a learning game already implemented on desktop computers and ported it to the mobile context. This ‘Number Jigsaw Puzzle’ (Figure 6) was based on an idea from Huang et al (2007), where operands have to be moved in a cell based pattern. The basic idea is that players must fill a three by three square with nine operands, such that the sums along the vertical columns, horizontal rows and diagonals equal a predefined value that has been set. Learners can derive a number of benefits from solving puzzles like this; they become involved in a process of inquiry and discovery, they develop strategies to find better solutions to a given problem, and they develop mathematical and logical thought processes (Huang et al., 2007).

In porting and adapting the game to the mobile context, a model of increasing challenge and reflection was adopted based on Sedig (1997), which in turn builds on Csikszentmihalyi’s Optimal Flow Learning Experience (1988).

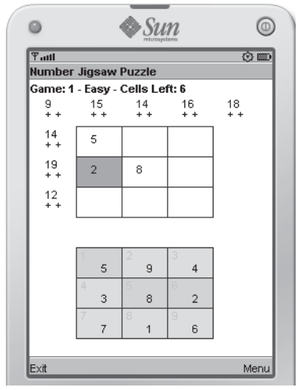

Figure 6. The number jigsaw puzzle.

Among the multi player collaborative systems was a word game based on hangman, though in this version the player loses if the princess gets eaten by the dragon (Figure 7). The design of the game was based on recommendations from Mitchell (2004) for developing mobile learning games, which include simple start-up procedures, minimizing levels of frustration and maximizing the likelihood of satisfactory outcomes, being appropriate for the device, encouraging cognitive skills, providing different kinds of feedback and playing with other learners. A key feature of this system is that the multi player interaction is supported by Bluetooth, making it free to play with others.

Figure 7. The multi player word game.

The games and quizzes developed by the students were interesting because in many cases they attempted to address not simply an arbitrary implementation, but based their work on some theoretical basis. Whilst there is perhaps an assumption that such activities tend to be engaging, creating immersive flow experiences, this can only be the case if the application design is appropriate to the learner. By considering such design issues gleaned from the literature, including the role of collaborative learning, these students were able to create systems that displayed such qualities.

Contextual learning

One system, based on the work of Wilhelm at al (2004), explored some useful design concepts in collaborative, contextual learning. In this system, photographs could be annotated in order to either ask questions or deliver information (Figure 8). This system takes full advantage of both the mobility and connectivity of mobile devices. Pictures can be taken in situ, annotated by the user and then sent to another person using Multimedia Messaging Service (MMS) messages. This communication could be from the teacher to the learner, providing information, or from the learner to the teacher, asking questions.

Figure 8. The image annotation system.

In conducting informal interviews based on the initial design and prototype of the system, the student gained positive responses from a number of interviewees. One, a painter with a number of apprentices, said it would be useful in managing the apprentices on remote sites, for example by ensuring that they were using the right paint in the right area by annotating photos of paint tins. Another respondent felt that the system would be very useful on their regular visits to China, where photos of signs could be annotated and sent to a translator.

DISCUSSION

We began this paper with a summary of Prensky’s (2005) mapping of technologies to applications, and followed this with an overview of a number of mobile learning applications developed by students. It is clear from these examples that a simple mapping between technology and application does not tell the whole story. In fact many of the applications we

have described combine together a number of technologies to create rich applications that leverage appropriate tools to meet user needs. We can see that an individual application may utilize more than one technical feature, depending on the nature of the client application. Clients may be thin (internet browser), thick (installed only on the device) or smart (utilizing both local applications and connectivity to servers and/or peers), and this functionality may switch between different modes depending on the current task. All of the examples shown here are of course downloadable programs, but in addition several of them use connectivity (internet, SMS, also MMS and Bluetooth) and several also use graphics, both image based and programmatically generated. Table 2 summarizes the richness of these applications, the range of client types, the application types (from Prensky's list), the variation in learning focus and the different types of learner engagement, which may be opportunistic (i.e. leaning in available moments), goal driven (e.g. passing a test), immersive (e.g. gaming), collaborative (working with other users) or contextual (working within a real world context).

Mobile Learning System	Client Type	Application Type	Learning focus	Engagement type
Geography Quiz	Thick	Downloadable Programs, Graphical Displays (Images)	Geography	Opportunistic, goal driven
Arithmetic Space Invaders	Thick	Downloadable Programs, Graphical Displays (Progammatic)	Mental arithmetic	Immersive
TxtInvaders	Thick - peer to peer	Downloadable Programs, Graphical Displays (Programmatic), Short Message Service (SMS) Text Messages	Vocabulary, strategy and mental arithmetic	Collaborative
Number Jigsaw Puzzle	Thick	Downloadable Programs, Graphical Displays (Programmatic)	Spatial problem solving and arithmetic	Immersive
Princess and Dragon Word Game	Thick – peer to peer	Downloadable Programs, Graphical Displays (Images and Programmatic), Bluetooth	Vocabulary	Collaborative
Driving Theory Test Preparation	Thick	Downloadable Programs, Graphical Displays (Images)	Road rules, event focused	Opportunistic, goal driven
Past Exam Revision	Smart - web	Downloadable Programs, Internet Browsers	General, event focused	Opportunistic, goal driven
Photo Annotation	Smart – peer to peer	Downloadable Programs, Graphical Displays (Images and Programmatic), Cameras and Video, MMS	Environmental / professional	Contextual, goal driven

Table 2. Categorising the mobile applications.

CONCLUSIONS

In this paper we have reviewed some student initiated mobile learning applications in order that we may gain some insight into learners' perceptions of what mobile learning applications might be like. Whilst there are many publications documenting types of mobile application, these have not been from the perspective of learner centred development tasks. By enabling learners to explore their own views of the potentials of mobile learning, we have been able to identify what they see as its core attractive features. As a result of the insights gained in this paper, mobile learning researchers can perhaps ensure a more reliable uptake of their systems by learners. In many cases we can see that the students have taken on board the key message that "Successful technologies are those that are in harmony with end-users' needs" (Shneiderman, 2002). The range of chosen technologies suggests that these learners are aware of the need to choose the appropriate technology for a given application, rather than applying a one size fits all approach. Some clients have no connectivity; others use various types of connectivity including the Web, SMS, MMS and Bluetooth. Some systems use text, others use images and others use generated graphics. If we compare the applications to Table 1, we can see that we have extensive coverage of most of the technologies suggested with the exception of voice and GPS. On the one hand we can say that this is partly a consequence of technical issues, because the device emulator system used by the class (Sun Java ME Wireless Toolkit) provides limited support for voice and location aware development. However we might also take into account that none of the applications described here would require location awareness and few would benefit from voice tools (except perhaps from an accessibility perspective.) Nevertheless, the fact that these features could usefully be overlaid onto some of the applications (for example location awareness could be added to the road rules system to ask context relevant questions) simply reinforces the fact that there is no simple mapping between chosen technology and application type.

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All figures are screen captures from Netbeans IDE 6.1, incorporating the Sun Java™ Wireless Toolkit 2.5.2 for CLDC.

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An Electronic Engineering Mobile Remote Laboratory

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ABSTRACT
A new architecture for the development of a wireless remotely controlled laboratory with focus on educational applications in electronics engineering is presented. The Internet is used as the communication infrastructure to enable remote students to access experimental equipment via mobile devices. The remote lab aims to support access of clients running on PCs or Personal Digital Assistant (PDA) devices while the server implementation was based on LabVIEW programming language. Experimental tools were created to allow users to collect data and information about the experiments, giving encouraging initial results where students are able to undertake simple engineering remote experimentation. Further experiments are envisaged and international collaboration is underway.

Author Keywords
Remote Labs, Mobile Content, Electronics Engineering Education, Curriculum Development

INTRODUCTION
The internet was first used in 1994 as a tele-control medium and subsequently applied in an educational context in 1996 when web-based laboratories were introduced by universities worldwide in undergraduate engineering courses (Aktan et al., 1996; Enloe et al., 1999; Shen et al., 1999). The evidence that the field of remote engineering has matured is overwhelming, particularly as indicated by the number of remote laboratories in operation today. Furthermore, the range of disciplines being taught continues to grow and collaborations between universities all over the world are becoming increasingly common (Lindsay & Good, 2005). Related training courses have also been explored in chemistry, physics and electrical engineering, and other interesting setups include remote experiment and virtual labs for wind tunnels, a virtual laboratory for exploiting DSP algorithms and a learning tool for chip manufacturing (Jeschke et al., 2008). Recently, a distributed laboratory was developed for the execution of virtual scientific experiments superimposed on a Grid infrastructure as part of a master degree in information networking (Christou et al., 2007). The opportunity to provide students with remote access to experimental hardware and the ability to offer flexibility in time and place in which laboratories are conducted are also becoming powerful motivations for the field (Al-Zoubi et al., 2005). Additionally, the recent advances in mobile technologies have lead to an increase in the number of internet users accessing information via mobile devices and the number of applications designed for such devices is growing and becoming increasingly popular. From the pedagogical viewpoint, students' expectations on how and when they learn are also creating increasingly heavy demands upon all aspects of their learning as young people are making mobile devices an extension of their personal space and fundamental to their daily lives. In response, the world is moving very rapidly to engage with the opportunities and flexibility offered by mobile technologies (Kennedy & Vogel, 2007).

Mobile remote solutions may therefore be attractive tools in enhancing access to practical experiments as they offer many different possibilities for applications in industry and education because they are not subjected to limitations of location and time (Doulgeri & Matiakis, 2006; Tzafestas et al., 2006). This, in combination with today's easy access to broadband internet, is transforming the way e-learning is carried out, allowing a higher level of interactivity and providing virtual environments closer to real ones. Hence, mobile remote systems can be very useful when applied to solutions involving high costs of people and equipment transportation. Different universities and institutions could share laboratory resources, expensive equipment and experiments by means of a cooperative network of remote systems.

In this paper, the possibility for students to access remote experiments via mobile devices is presented. The proposed approach is to implement a client for Personal Digital Assistants (PDAs) which may be programmed in LabVIEW, with a module that suits applications on handheld devices. Communication between the server and the mobile client was based on direct TCP/IP programming to facilitate data transfer through the internet. Experimental tools were created to allow the user to collect data and information about the experiments. Initial results are very encouraging, with students able to undertake simple engineering remote experimentation, and further experiments and international collaborations are underway.

THE LABVIEW PDA MODULE
An effective way of improving technology-enhanced engineering education is to combine theory and practice simultaneously in the same lesson. The most convenient and popular environment to implement virtual and remote experimentations is probably the Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW) programming language, which has been extensively used for such purposes. LabVIEW is a high-level user-friendly graphical programming language developed by National Instrument (NI) for use by scientists and engineers, particularly for data processing and acquisitions applications. LabVIEW employs special controls to form instructions and icons to build subroutines, wired together in order to define the flow of data through the program. In this context, LabVIEW is a visual language and not text-based, where the code is governed by a series of rules based syntax such as commas, periods, semicolons, square brackets, curly brackets, round brackets, and others. To the contrary, LabVIEW flowcharts the code as it is written to produce a program in a timely and efficient manner. This programming approach is based on building blocks called Virtual Instruments (VIs); each contains three main parts: front panel, block diagram, and icon/connector. The front panel is a means of interaction between the user and the block diagram (program) when the program is running. Users may utilize the front panel to control the program, alter inputs, and monitor changes, updates and other variations in real time. Indicators are program outputs used to show the status of program variables, parameters, flags or other types of data, states, and other information. Front panel objects appear as terminals on the block diagram where every control and indicator has a corresponding terminal which contains the graphical source code. Additionally, certain functions and structures which reside in built-in LabVIEW VI libraries are used in the block diagram.

A special add-on LabVIEW module has also been devised by National Instruments to allow one to run LabVIEW virtual instruments (VIs) on PDA execution targets. The module is a good tool for creating data acquisition and remote system monitoring applications that are both portable and flexible. The LabVIEW PDA module is usually operated with an emulator that can be used to test the application inside a simulated environment to mimic the behavior of the actual PDA. It gives additional flexibility in the design and testing, and establishes greater confidence that the applications will behave as intended. It facilitates the development of graphical environments to create custom applications for a multitude of mobile devices and PDAs. The programmer is thus given the choice to select the appropriate operating system that will be implemented in the design before commencing with writing the program. In addition, the LabVIEW PDA module allows the creation of custom, user-defined applications for Palm, Windows Mobile for Pocket PC, and Windows CE devices. This can be achieved with a LabVIEW programming environment the same way it is made for a PC application, but deployed into a PDA. It also allows the development of data acquisition applications with Compact Flash and PCMCIA DAQ cards. Furthermore, the PDA module includes some libraries of sub VIs developed to take advantage of additional resources available on PDAs and Smartphone, like short message services (SMS) and telephony. Besides, it is also possible to use most of the known functions and APIs available when developing applications for PCs with the LabVIEW PDA module for the most common operating systems found on these devices, like Windows Mobile or Palm OS, and to deploy it for emulated devices or real ones via the proper synchronization tool like Microsoft Activesync for Windows Mobile. Due to the limited graphical capabilities of these devices, however, the controls and indicators are sized and scaled, and the functions palettes are reconfigured.

ARCHITECTURE OF THE MOBILE REMOTE LAB
The application of interest here is to enable electrical engineering students to revise material anywhere at anytime. The material may be in the form of text, equations, figures, intimations, and circuits. However, it is also important for students to conduct experimental work virtually by simulation or remotely by accessing laboratory set-ups through the internet. This may be achieved utilizing the graphical interface capability and web publishing facility of LabVIEW. In addition, a lesson may consist of text, figures and circuits and necessitate the use of multi-screen design. This requires the program to navigate from one page to another due to the limited screen capacity. Several methods have been implemented to manage this situation, including the use of hyperlinks and buttons, as well as the attempt to interface LabVIEW with other programming languages such as Java. The use of tab pages, however, has been found the most suitable convenient solution to navigate between pages in this particular application.

A system was designed into the architecture shown in Fig. (1) to perform remote real electronic experiments via the internet. This architecture shows the methodology of how remote clients will connect to the remote lab. The user interface and the control of the lab hardware were developed with LabVIEW virtual instruments (VIs) to design front panels which resemble the front view of a real oscilloscope and a function generator, for example, and to have nearly the same functionalities as real devices. These VIs were then embedded into HTML and published on the Web server which also hosts the remote laboratory home page, with information about the implemented exercises as well as links to the system login. The front panels could then be remotely reached via a standard Web browser which does not require any prior user knowledge of LabVIEW to take advantage of the system facilities. In fact, the client simply needs a standard Web browser and a proper version of the LabVIEW run-time engine that contains some libraries and web browser plug-ins. This software is available free of cost at the National Instruments website and is automatically downloaded on the first attempt to access the system. In addition, the driver software has an application programming interface (API), which is a library of VIs, functions, classes, attributes, and properties for creating applications. This library of polymorphic VIs replaces large parts of a complex DAQ application with a simple configuration dialog.

Students may be able to enter a remote laboratory and carry out electronics experiments from anywhere at anytime. The proposed approach is to implement a client PDA which may communicate with the Web and VI severs directly with

transmission control protocol (TCP), internet protocol (IP), or user datagram protocol (UDP) being the basic standard protocols for network communications and data transfer through the internet. TCP/IP communication provides a simple user interface that conceals the complexities of ensuring reliable network communications. TCP describes communication between applications and permits multiple simultaneous connections which must be established prior to data transmission, thus necessitating the specification of an address and a port at that address when a client requires communication with a server. A connection is initiated by waiting for an incoming connection or by actively seeking a connection with that specified address. After a "handshake" between the two applications, TCP sets up "full-duplex" communication between the client and a server. On the other hand, IP is a “connectionless” communication protocol responsible for routing a packet to its destination. LabVIEW offers an API for developing applications that includes TCP/IP and UDP functions used to create client and server VIs on all platforms. The responses are read, for example, with the aid of the NI DAQmx driver software. Only one user can access the remote lab at a time, however, and therefore each user is allocated a thirty minutes time-slot to access the system by first entering a username and a password. If both are valid, the system enables access to the lab.

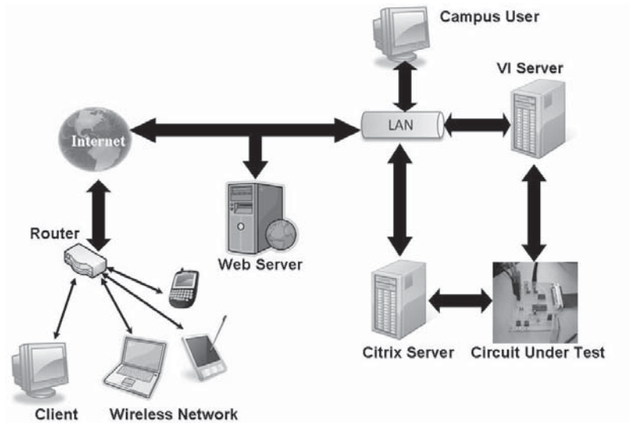
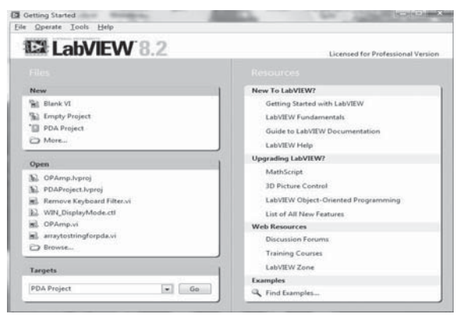


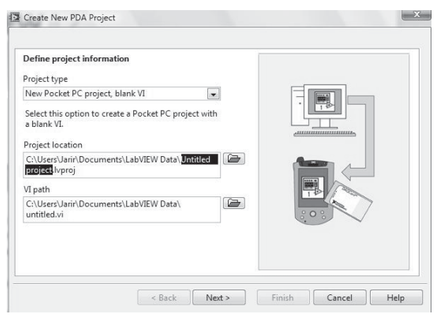
Figure 1. Mobile Remote Laboratory Architecture.

Programme Design

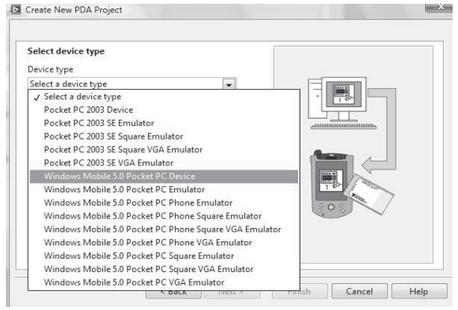
A new PDA application is built on the LabVIEW when the programmer selects a PDA project from the targets list on the “getting started” screen, as shown in Fig. (2a). The next screen is a “create new PDA project” that allows the selection of a project type from the project type list. A new VI can be created by selecting ”blank VI,” whereas “import VI” is used to open an existing VI template, determine the project location and VI path. The project files are then created on the selected path as shown in Fig. (2b). The device type is subsequently chosen from a list which conforms with actual the PDA operating system Fig. (2c). Another list also appears to select VI template as a pocket PC landscape screen or pocket PC portrait screen Fig. (2d).



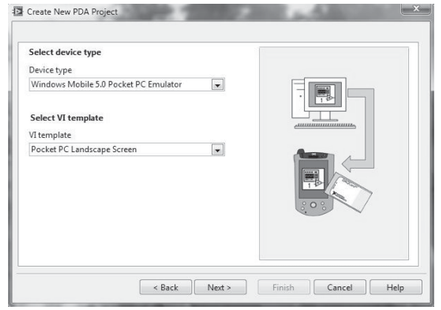
(a) Getting Started” with Mobile Module.



(b) “Create New PDA Project” Option.



(c) Device Type Selection.



(d) Landscape or Portrait Screen Options.

Figure 2. Building a Project on LabVIEW PDA Module.

The application of interest here is to enable electrical engineering students to access the content of the “Analog Electronic” course at Princess Sumaya University for Technology. The main part of the course focuses on the design, analysis and applications operational amplifiers in electrical systems. The material usually takes the form of text, equations, figures, animations, circuits’ diagrams, displays, and graphs. This requires the program to navigate from one page to another due to the limited capacity of the screen. Several methods have been implemented to manage this situation, including the use of hyperlinks and buttons, as well as the attempt to interface LabVIEW with other programming languages such as Java. The use of tab pages has, however, been found the most suitable convenient solution to navigate between pages in this particular application.

The first tab page contains an introduction about the subject of the lesson. The student can revise the lesson before conducting the experiment. The next tab is op amp circuit figure with variable controller and scope. The user can see the circuit and set the variables for the frequency and amplitude of the input signal and the resistance values. The program then generates the signal from the set values of frequency and amplitude, and feeds this signal to input of the op amp to produce the output; when the ‘Show’ button is clicked, the op amp generates the output signal and draws it on the scope as shown in Fig. (2). In the results tab page the user can read a conclusion for the experiment, then take an offline quiz in the last tab page. This tab page is designed to ensure students’ understanding and comprehension of the experiment. The student can navigate tab pages forward and backward to review the lesson content at any time.

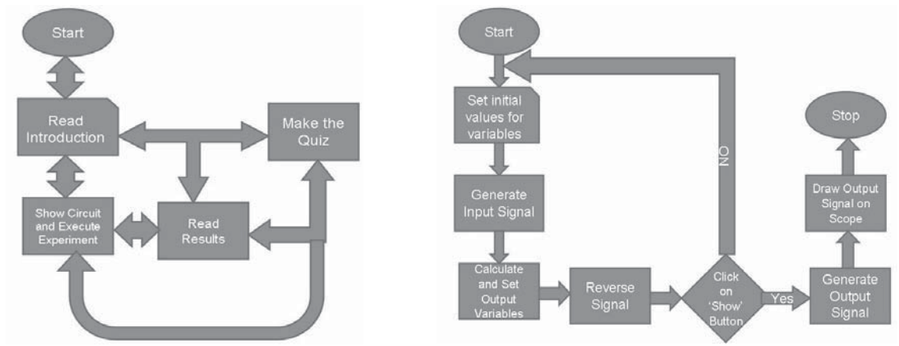


Figure 3. Program Flowchart.

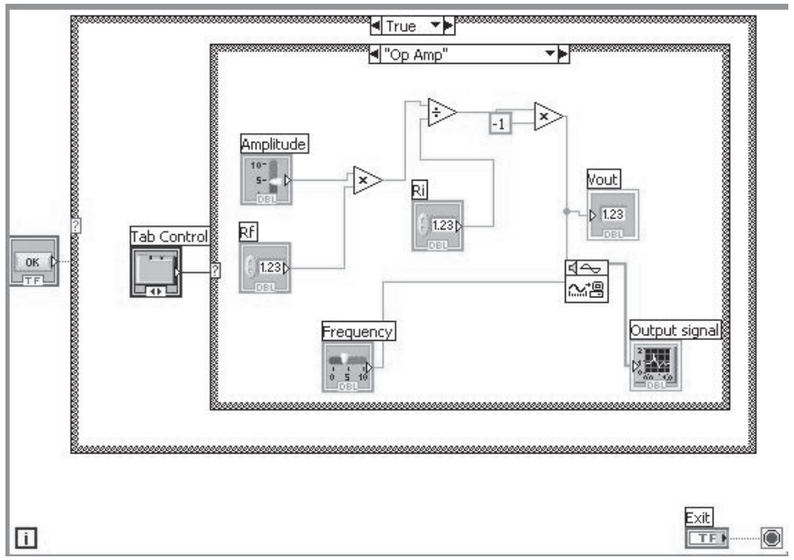
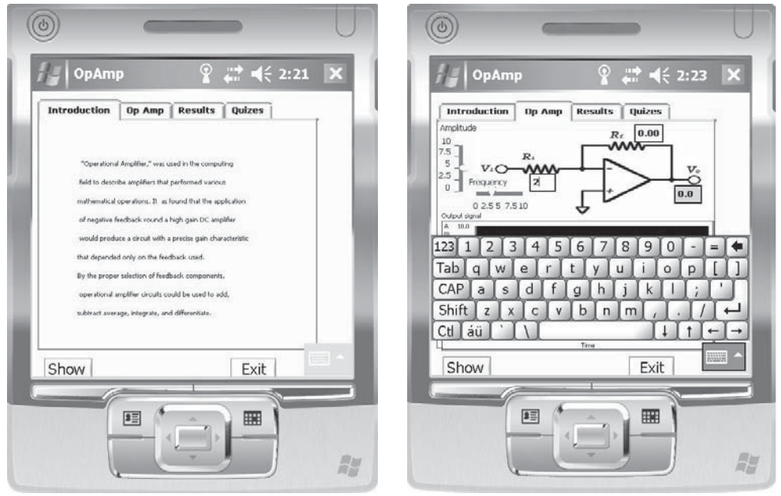


Figure 4. Block Diagram of the LabView Application Program.

RESULTS AND DISCUSSION

The types of experiments under consideration were mainly electronic circuits at the junior undergraduate level for electrical engineering students at the Princess Sumaya University for Technology. Clients were designed for PDAs as well as for Windows PCs, and requests from both were treated seamlessly by the server. Due to resource constraints of PDA devices, not all the features designed for a client running on a PC are performed when accessing the system via PDAs, but this can be managed just by changing the client application. A simple experiment to generate a number of waveforms with varying amplitudes, frequencies, and shapes was initially performed remotely on a PDA to control and simulate an actual function generator. The most important consideration, however, was the limited resources of mobile devices compared to PCs, which lead to a reduction of the features available for designing the mobile remote laboratory. Nonetheless, the proposed solutions remain applicable to a number of experiments such as an operational amplifier which can be used to implement a number of mathematical operations such as summing two signals or subtracting them; integrating or differentiating a signal, detecting its peak, or even generating one; in addition to many other applications. One experiment was performed on an operational amplifier employing the proposed mobile remote lab as shown in Fig. (5), where a student first goes through an introduction explaining the main features of the device and its operation, then an output for an inverting amplifier is displayed and the gain calculated. The student may also vary the frequency of the signal or its amplitude and observe the effect on the signal output and gain in real time.



(a) Introduction.

(b) Experiment on an Operational Amplifier.

(c) Amplifier Output and Display.

(d) Amplifier Gain Calculation.

Figure 5. Results of the Mobile Remote Lab.

In Fig. (5) it can be seen that the student can adjust the appropriate knobs until the required conditions have been satisfactorily achieved, thereby giving the possibility to access the equipment directly and providing the student with an environment that mimics the actual one. In cases where real measurements are required rather than just controlling equipment, the measured data can be made available through the LabVIEW program, e.g. in the format of an Excel sheet, for further analysis, enabling the students to directly compare the prognoses from the model with the results of their own measurements. In this context further experiments are being carried out to see how students perceive this remote lab technology, particularly with a laboratory such as the electronics lab, where sharing of expensive equipment is of paramount importance. This remote laboratory is to be integrated in the final examination of the lecture, giving an opportunity to verify whether the theoretical knowledge from the lecture has been transferred to practical knowledge that can be applied to a real world scenario by the students. Where initial results have been encouraging as students are able to undertake simple engineering remote tasks, further experiments are being prepared.

CONCLUSIONS

A new wireless remote lab system was developed to enable students to access experiments via the internet from their mobile devices. The types of experiments under consideration were mainly electronic circuits. Student clients were able to access the remote lab using a PDA which communicates with the server controlling the equipment. The most important consideration, however, was the limited resources of mobile devices compared to PCs, which lead to a reduction of the features available for designing the mobile remote laboratory. The proposed solutions, however, remain applicable to other labs and experiments because they are easy to adopt standard solution. The initial results are very encouraging, with students able to undertake simple engineering remote experimentation. It can be still argued that learning environments will remain a combination of wired and wireless for the foreseeable future, as not all affordances offered by wired environments are transferable to small mobile devices. Further experiments and international collaborations are underway.

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Text in the City – Competing "Translations" in a Metropolitan University

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ABSTRACT

It is well understood that introducing mobile learning technologies into Higher Education is not without issues. M-Learning has the power to be highly disruptive to the way university courses are delivered and raises issues not only about how people teach and learn, but also has the ability to challenge the culture and structure of the educational institute itself (Bird and Stubbs, 2008; Kukulska-Hulme and Traxler, 2005). Introducing a scheme where lecturers' announcements in a VLE (Virtual Learning Environment) are directed to students via SMS would appear to be straightforward, given that it doesn't increase the tutors' workload and almost all students have suitable devices. However, even with this apparently simple upgrade to a VLE there are competing solutions, divergent requirements, data protection and software integration issues. The paper looks at experiences in a current trial project and analyses some of the issues using Actor Network Theory (ANT). It also suggests changes in organisational practice that might help to solve these conflicts and unify requirements and solutions.

Author Keywords

Text Messaging, Innovation, Actor Network Theory, Higher Education

INTRODUCTION

This large university based in a major city in the North of England has recognised the potential of using SMS (Short Message Service) as a means of communicating information to its students. The university is keen to improve student experience, and has targeted frustration arising when lectures are cancelled or their location changed as an area for improvement. Mobile phone penetration is almost ubiquitous within the university student population, so the expectation is that the opportunity to receive important information by text would be popular with students.

In 2008 the university bid successfully for funding from the JISC (Joint Information Systems Committee) under a research program designed to explore institutional responses to emerging technologies. The idea behind the project was simple: connect the announcement feature in the VLE (Virtual Learning Environment) with text messaging so that certain classes of announcement could be notified to the student by text or RSS feed. Currently, students have to log in to the VLE in order to see any announcements and hence have to poll the VLE regularly to get updates. The project was to be a trial involving students in different faculties: Law, Biology, Computing and Business. The main focus of the project was to allow tutors to place urgent announcements onto course pages on the VLE, which in turn would be converted to SMS and sent to a subscribed list of students. Urgent announcements were classified as events such as lecture cancellations or room changes, but also could extend to events like reminding students of assessment submission deadlines or telling them when marked assignments could be collected. The value of this classification was verified with students through the trial. As well as providing an SMS option for urgent announcements, the students could also subscribe to RSS feeds for all course announcements whether these were urgent or not. The expectation was that that the majority of students would view the RSS feeds through a portal such as iGoogle, but those with smartphones/PDAs would also have the possibility of viewing the feed on their mobile device.

The JISC-supported project was not the only attempt by the university to connect with its student population by text messaging. For a number of years, the university had subscribed to a service where text messages could be sent to a list of mobile phone numbers. This service was a standalone application and had no connection with the VLE. Its main use had been via administrators who sent occasional messages to groups of students, such as when exam venues were changed. Some tutors had also used this service to transmit the sorts of information that the JISC-funded project was covering, but this type of use had been very sporadic.

Finally, there was a third service introduced by the student union. Its aim was to supply a text number where students could report occasions when they had turned up for a lecture/tutorial only to find it wasn't happening. Information from this service was then passed to faculty heads on a monthly basis. Although the motivation for this service was different, including the reporting of occasions where tutors had failed to show, there is considerable overlap since many of the messages would refer to situations where a room had been changed or a lecture had been cancelled but the student hadn't seen any notification of this.

Against this background of three potentially overlapping and competing services, there were efforts by the university to improve student experience, and text messaging was seen as one method of achieving better communication. There is no

doubt that being unaware of events such as changes of room led to negative feedback in student satisfaction surveys. However the university was cautious about embracing text messaging on a wider-scale, since there were perceptions in the university executive that students frequently changed their mobile phone numbers and thus text messaging might prove no more effective than other channels.

The JISC-funded project had three main questions:

1) What were students' requirements for an SMS-alerting service, and did they change numbers on a frequent basis?

2) What would be the take up of the service, and what would students and staff think of it?

3) Could the competing text messaging services be unified into one strategy?

THEORETICAL CONTEXT

The context of the research was driven from two standpoints: what had previous research said about text messaging in Higher Education as a communication tool, and secondly what theoretical lens could we use to look at the issue of the competing solutions where there was an apparent lack of institutional strategy for mobile communications.

There have been many trials of text messaging in Higher Education, ranging from interactive language teaching (Markett et. al, 2006; Kukulska-Hulme, 2006) to administrative messaging which is similar to our own project (Naismith, 2007; Nix et. al, 2006; Riordan and Traxler, 2005). Naismith (2007) states that reminders of assignment due dates, lecture cancellations and room changes were seen as appropriate text messages by students but that students were slightly wary that the university might use SMS to bombard them with advertising for campus-based services. Interestingly the students in this earlier research appreciated that the text messaging was a one-way service and they preferred to use email to send in their own queries. Administrators also felt that students didn't check their university email accounts regularly, but SMS was a better way to ensure that the announcements were received.

Traxler and Riordan (2005), in their study of bulk targeted SMS at the University of Wolverhampton, also report that students were positively disposed towards SMS to support their studies. They also acknowledge that there might be different types of systems employed, from applications which are standalone SMS texting systems, through applications that offer SMS delivery as a feature, to components which integrate SMS into other applications. They also refer to a number of institutional issues with scaling up these trials into campus-wide services, such as the impact on those not having a mobile phone (inclusion), the business justification and cost of scaling up an SMS service and ethical issues such as how the university stores and uses the students' mobile phone number (Riordan and Traxler, 2005). Yet other administrative uses of text messaging have emerged, such as one where the University of Ulster used text messaging to target students with low attendance to remind them of lectures/tutorials, which contributed to improved student retention (Nix et al. 2006).

These previous studies led us to expect a positive response from students to the prospect of providing urgent VLE announcements through SMS, and highlighted that there might be some institutional issues to manage. The presence of competing SMS applications within the university encouraged us to seek a theoretical context for understanding issues of embedding mobile communications in institutional practice. There has been widespread use of activity theory (Engstrom, 1987) to look at the introduction of mobile technology into education. Although that might prove a suitable lens, we were attracted to Actor Network theory (ANT) and its ideas of competing translations, especially in the context of looking at the introduction of an innovation (SMS) into a university organization with its diverse faculty structure, loosely tied together by a central administration.

Actor Network Theory (ANT) introduces the concept that 'agency' (Latour, 2005) resides both in people and objects such as technical innovations. Agency is usually thought of in terms of humans making conscious decisions to exert influence, but Actor Network Theory proposes that objects can also have agency, an example being a particular technology having influence (i.e. agency) over how humans perform certain tasks. Text messaging is a good example in that it has changed the way that many people organize their social lives, much to the surprise of both technologists and sociologists (Faulkner and Culwin, 2005). Furthermore in our case, the existence of text messaging has led different groups within the university to see possibilities to improve the student experience.

ANT prescribes that all entities, both human and non-human, be subjected to the same process of social analysis (Law, 1994). ANT identifies the set of processes involved in projects of social ordering as networks and looks at the changes that take place in those networks through a project. ANT also provides a concept of translation whereby people, objects and processes have specific 'needs' which are translated into more general and unified needs, enabling all needs to be met by one solution. When a system is introduced it gets adopted by the users by translating it into their own context and reflecting their work tasks and situations (Latour, 2005). ANT also provides a concept of irreversibility where a network is established that can resist competing translations, making the change irreversible. Actor Network Theory may provide a useful model for looking at m-learning in higher education, as the various actors (the university, teachers, students, IT services, the innovation itself etc.) could be viewed as undergoing a process of translation in order to find a stable way of working together. Notions of reversibility of current arrangements within universities, and the processes of translation orchestrated by those championing the introduction of m-learning, may enable important differences to be identified between universities that successfully and sustainably embrace and implement forms of m-learning and those that are

If we think about these text messaging services as innovations, then in order for them to succeed a range of departments, staff and policies will have to undergo change before it becomes an irreversible feature of the university environment. In Actor Network Theory terms, these are all actors in a network and will have to undergo a set of translations. 'Mediators and intermediaries' will have to form relationships so that the processes and departments translate into a network (Latour, 2005, p.40). If the technology is to become established then the actors will have to undergo irreversible change (Callon, 1991) and that degree of irreversibility will depend on whether it remains an isolated example or whether it sustains and starts to shape and determine subsequent translations (Callon, 1991, p.159). So, are our three different text messaging initiatives isolated examples, each of which might fail to sustain? Or are they capable of creating an irreversible translation and hence become sustainable services?

Whilst Actor Network Theory and its notions of networks and translations would seem to lend itself as a method of looking at how these barriers are overcome, another part of ANT is even more promising. Looking at project failure in the aircraft manufacturing industry, Law and Callon (1992) came up with the concept of local and global networks and the boundaries between the two. They identify three factors which influence the success or failure of the project, with the most significant being 'the capacity of the project to build and maintain a global network which will for a time provide resources of various kinds in the expectation of an ultimate return.' They also talk about obligatory points of passage between the two networks, which could be powerful individuals who exert influence over the global network or even powerful groups of people, such as strategy groups or committees.

These text messaging projects can to some extent exist in isolation and do not require universal acceptance by the university to exist. But they eventually interact with the global network (the university as a whole) as the practice spreads to other lecturers and faculties, leading to new and potentially divergent requirements. Therefore significant factors will be the ability of the local network to build links with the global network and influence the global network to approve and support the innovation. Actors, be they individuals or groups, will have to become obligatory points of passage between the two networks for that influence and support to be achieved and for requirements to unify. This use of Law and Callon's local and global network concept has not been applied to this type of IT project before, and thus its usage represents the major contribution to knowledge of this paper.

METHOD

There were two strands to the research. For the VLE-based service, we wanted to look at what students' mobile phone habits were in terms of changing numbers and using different types of services such as subscribing to text messaging-based information services and what types of information they would like to receive by text message. The survey known as the "pre-survey" was advertised to all students from cohorts who participated in the trial, and took the form of an online questionnaire which was completed by 141 students in total. This pre-survey will be followed up with further online surveys to get feedback on the live service.

For the wider issue of the competing types of SMS-based service, data was gathered by interviewing key players across the university to see what their requirements were and what issues they had with their services to see how these could be reconciled into one sustainable, text-messaging strategy.

RESULTS

The Pre-Survey

Firstly, 100% of respondents had a mobile phone, making it more likely that the institution has a near 100% mobile phone coverage in its student population. All messages sent in the trial were also available via the VLE to avoid excluding anyone from at least one method of accessing the information. In terms of the university executive's concern that students might frequently change their phone number, it appears that more than 86% are unlikely to change their number in any one year, so if we take in a set of numbers at the start of an academic year we might reasonably expect the vast majority of messages will reach subscribers.

	Never	Every few years	Once a year	More than once a year	Valid *n*
How often do you change your mobile phone number?	73 (53%)	46 (33%)	15 (11%)	4 (3%)	141

Table 1. Frequency of mobile phone number change

We also looked at how students currently found out about some of the events that our service was seeking to inform them. Students were able to select a number of options so it is interesting to note that the number of students using the VLE to find out the information appears less than those using more traditional methods of hearing it from the tutor or via student colleagues. This leads to speculation as to whether text-messaging will be more effective as a means of communication, given that the existing electronic means (the VLE) does not seem to be the dominant method.

	VLE announcements	VLE other	Email	From the lecturer directly	From other students	Other	Don't receive this info
Timetable changes	66	28	23	75	63	7	15
Reminders of assessment deadlines	64	35	8	70	67	7	13
Assessment marks available	63	44	18	62	39	4	4
Assessment details available	62	48	13	76	41	2	5
Tutorial preparation tasks	42	37	5	86	38	9	11
Additional resources available	39	36	8	68	26	0	35

Table 2. Spread of existing methods of informing announcements

The next table shows how popular different types of announcement via SMS would be. It is interesting to note that students place high importance on events associated with changes to their schedule, such as lecture cancellation, but they also place high importance on events around assessment, such as reminders of deadlines. They place less (although still significant) importance on the more regular course events of information on tutorials.

Course announcements to mobile phone?	This service would be useful
Cancelled lectures	140 (99%)
Timetable changes	131 (92%)
Assessment marks available	124 (88%)
Reminders of assessment deadlines	121 (86%)
Assessment details available	98 (70%)
Information on tutorial preparation tasks	87 (62%)
Additional resources available	66 (47%)

Table 3. Perceived usefulness of different announcement types

DISCUSSION

Reflections on the trial

The trial has now been running for a whole term and a number of issues have arisen:

Enrolment rate. Around 200 students have so far signed up for the service out of a potential "market" of over 1600 students. This seems disappointing given that this is less than 15% of the possible total. It is too early to say with certainty why this is the case but early reasons given are:

- Infrequency of events such as cancellations and room changes mean that few urgent messages are currently going through the service. It may need a whole academic year or more to embed the service such that students get to hear about a number of events where the text messages have saved them from arriving in the wrong place at the wrong time.
- A reluctance to give the university a personal mobile phone number in case it is used to communicate other information, despite assurances that this won't happen when the student enrols into the service. Previous studies have found this to be an issue.
- A lack of marketing of the service. The service has been marketed verbally in lectures by tutors and also through the VLE. However it is known that not all students engage with the VLE or respond to encouragement from their tutors. For the service to embed, it would have to be extensively marketed through student induction and handbooks, and also through the student union.

Confusion over which service. Some departments who participated in the VLE trial are also experimenting with the alternative university service. There is a conflict here between the requirements of tutors whose world is course-unit based and administrators who may have notices to communicate to students which are not specific to individual course-units or even groups of course units. For example, tutors will want to remind students of unit assessment deadlines,

whereas administrators may want to tell the entire student body in their faculty of events such as exam timetable changes. Clearly whilst communication to students enrolled on a course-unit fits neatly into the VLE-based announcement system, announcements to the whole faculty do not (unless VLE groups have been set up for this purpose). The university needs to recognise that there may well be the need for these two types of service, and develop a strategy and resulting policies which give clear guidelines on which service to use.

Ethical/Data Protection issues. The VLE-based service relies on subscribers providing their mobile phone number so it is a conscious decision by the student to opt-in to receiving messages. The university administrator system takes the mobile phone numbers from students' enrolment forms. Whilst the student knows that they are supplying their phone number for contact purposes they may not be aware that this will be used to send text messages to them. Although this is not breaking any data protection legislation, best practice would suggest that the students should be given the opportunity to opt-out of receiving text messages from the university if they so wish (Riordan and Traxler, 2005). There are also issues of accuracy in this method in terms of up-to-date mobile phone numbers, as many students do not supply a number and others may change them during the three or four years of their course without updating their university records - this issue links back to the enrolment above. Enrolment by choice may lead to low subscription rates, whilst enrolment by default may lead to an inaccurate mobile phone number list.

Different interface requirements. At first glance, it may appear somewhat inefficient that the university is using more than one provider of text messaging software and services. The original system procured by administrators was designed to run as a desktop application and did not have an interface which could be called from within a program. The VLE-based text-messaging system needed an application programming interface (API) to embed the text-messaging facility and had to procure a solution from a different supplier. The university needs to recognise that there are different methods of accessing a text-messaging facility, and this is borne out by previous research (Riordan & Traxler, 2005). It is then purely a case of whether this can be efficiently achieved through one product. After all, mobile telephony is a commodity and it is not unusual for organisations or even individuals to use different providers for different services.

The Competing Solutions

In Actor Network Terms, we seem to have a case of competing translations. It appears to be a case of divergent requirements that are not being translated into one set of unified requirements which can be accommodated into one solution. The next diagram looks at the competing requirements:

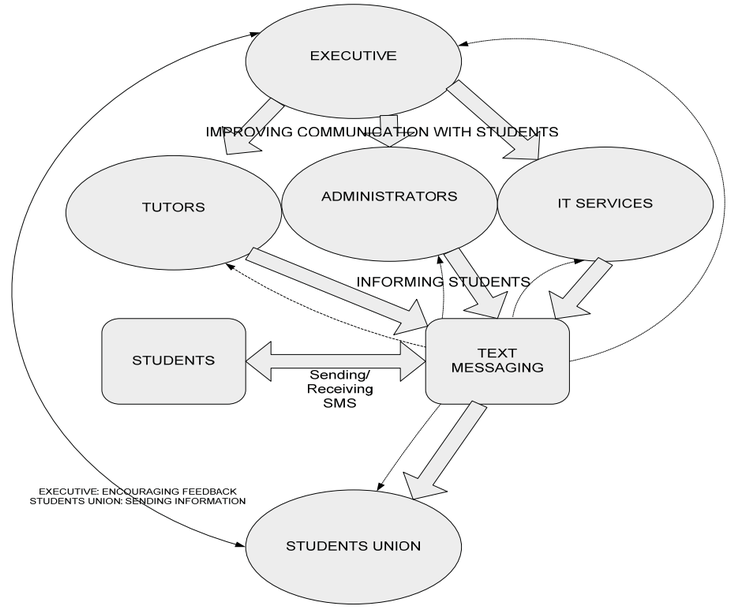

Figure 1. Actors in the university "global" network

Looking at the interests of each actor, evidence suggests:

The Executive. Wants to improve student experience and avoid situations where students fail to find out about cancelled or changed lectures. Attracted to text-messaging but concerned about costs and the churn rate in student mobile phone

numbers. Broadly supportive of student union text messaging initiative but may not be getting enough management information it can use to rectify problems.

Administrators. See text-messaging as a means of getting information to students quickly. Want an easy-to-use package which enables this and clear guidelines of how to send out messages in certain situations.

Tutors. See text messaging as a new channel for connecting to students but need a policy of how and when to use it. Some are suspicious of student union text-messaging project as a means of "rat on your teacher" as opposed to a feedback mechanism on effective communication.

IT Services. Responsible for the VLE and see text messaging as a useful extension to the service. Concerned about proliferation of solutions.

The Student Union. Keen to give the executive feedback on student experience but understandably wants to remain independent of university-provided services.

Students. Appear to be enthusiastic towards text-messaging but aren't necessarily engaging with the university initiatives in large numbers.

Text messaging technology. In Latour's sense very much an actor in the network. Easy to use and inexpensive to procure, it "encourages" a proliferation of solutions.

This has led to the next diagram which shows that subsets of these requirements have led to the three different "local" networks.

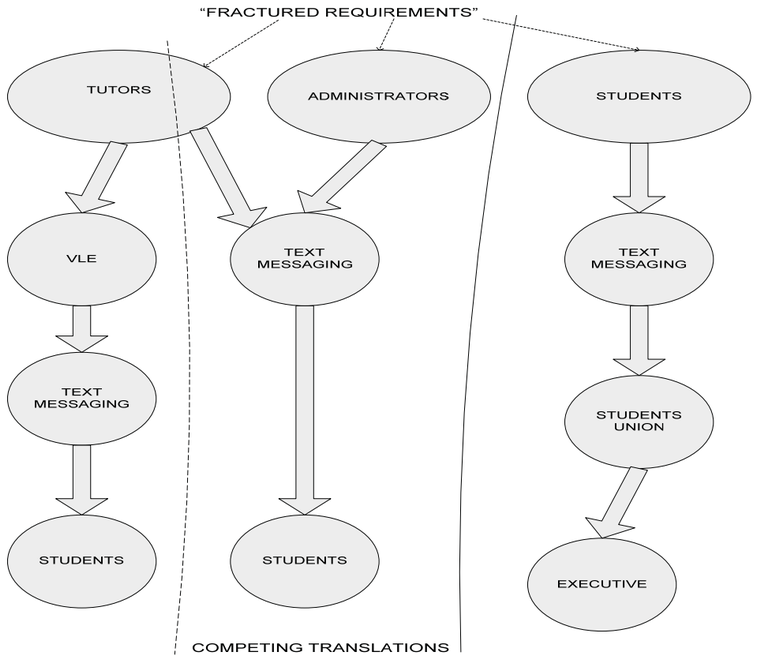

Figure 2. Competing translations leading to divergent "local" networks

What we may be seeing is a situation where all of these requirements can lead to divergent solution because in ANT terms there is no place where they come together into a single strategy, an obligatory point of passage. Without such a point of passage the solutions could continue to diverge and indeed multiply as different parts of the university look to use text messaging. For example, finance are looking to use text messaging to remind students of tuition or accommodation fee deadlines and the library is considering its use in sending reminders of overdue books. The university is also split across seven sites and thus vulnerable to independent solutions.

CONCLUSION

There are two main issues that arise from the university's courtship with text messaging. How can we avoid a proliferation of different solutions or "translations," and will text messaging prove as effective and popular with student communication as we might anticipate?

Existing research shows that an "obligatory point of passage" (Law and Callon, 1991) might help avoid the problem of different actors' requirements fracturing into multiple text messaging solutions or competing translations. The university has recently created a forum to ensure it responds strategically to the development of its IT capability. The newly-created ICT Strategy Group comprises key university decision-makers (a subset of university directors), who ensure that development initiatives are evaluated and monitored in terms of university objectives. The group is introducing the notion of a three stage trajectory for ICT innovations: experiment, pilot and service - to permit innovation to flourish within clear guidelines. Checkpoint criteria are being established for deciding whether or not an experiment would go forward to a pilot, and a pilot to a service. These criteria mandate consideration of institutional embedding, marketing, administration, finance and the like, commensurate with the scale of the innovation's impact. This research project will monitor how text messaging responds to this new initiative to see whether it indeed creates that obligatory point of passage which unifies requirements into a single coherent strategy.

On the topic of whether text messaging will prove a panacea in improving student communication, it is too early to say. This needs to be judged fairly once the service has been running for at least a whole academic year. Anecdotal evidence from colleagues in other universities suggest that some students may see their mobile phone as a personal communication space and may not want this "invaded" by messages from their academic world, rather akin to the debate on whether educators and students should be using social network spaces such as Facebook rather than Virtual Learning Environments. Perhaps this is telling us that text messaging is just one form of communication, which subsets of our student population will embrace whilst others stick to using the VLE or staying informed by traditional word of mouth methods. In addition, our data on the way students currently access information (table 2) suggests that a significant proportion get information by traditional methods so even the existing and embedded VLE is not dominating this form of communication. We should not expect SMS to be an immediate success.

The major contribution of this paper was to use Actor Network Theory to look at issues of embedding mobile technologies in university environments. The initial results seem promising, and ANT with its ideas of translations, local/global networks and obligatory points of passage may indeed form a useful lens for both researching the embedding process and informing practice.

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Learning across the Border towards a Global Mobile Community: Context-based, Communicative and Collaborative

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ABSTRACT
The convergence of digital mobile tools and social software starts a new opportunity for learning across the border. In this research, studies on the applications of social software in learning, such as mobile Instant Messenger (IM) and mobile group blog were conducted. Both Chinese overseas students in the UK and those in China were investigated in this research to explore the real borderless learning occurring with the aid of mobile social software. A framework of a global mobile community for learning is illustrated. Features and elements of this mobile community-based learning are highlighted.

Author Keywords
Context, global mobile community, communication, collaboration

INTRODUCTION
Society is becoming more and more organized around electronic communications with increasingly multi-purpose handheld devices. Ubiquitous computing available everywhere, all the time fulfilled the demands that users expect to always remain connected during their nomadic roaming. This expectation is beginning to include overseas students (Lee, 2006). The word 'mobile' not only stands for the fact that now technology is getting portable, but everything is mobile including people. People are mobile and they need connection, communication and interaction on the move. Mobile technology is designed and developed for the sake of connecting mobile people, which is called user-centered mobile technology.

Mobile applications are a very good source of social context data (Bleecker, 2006); they increasingly facilitate social and always-on learning practices. The use of social software (Web 2.0) and digital mobile tools are two of the latest trends in new teaching and learning practices that enable this connectedness and have demonstrably positive effects on learning (Low, 2006). In Web 2.0, virtual communities connected by network have made the world smaller, especially for the users who access social software from their homes or work places (Buriano, 2007).Mobile 2.0 services integrate the social web with the core aspects of mobility – personal, localized, always-on and ever-present (Jaokar, 2006). This greatly expands the realm of learning in different contexts in everyday life, bridging the gap between the virtual world online and the real world.

If learners try to do learning in everyday contexts, they always learn through rich social interactions in the community. When learning happens in everyday social life, more associations and connections are needed through the review of multiple perspectives, enriching the learning experience (Honebein, 1996). A number of social online software added new mobile plug-ins or features to help 'mobile' people communicate on the go with web connections. The famous social software Facebook, which has strong "group" features, launched its mobile feature recently to enable messaging on the go. In this paper we propose the elements of a mobile learning community in a global condition and describe features and factors in this community based on the investigation and case studies on IM and Moblog.

BORDERLESS LEARNING OPPORTUNITIES
Before we go straight to the technology, we may have an overview about the changing opportunities of learning. As higher education opens up to world markets due to the recent advances in communication technology, diverse education providers have also dramatically evolved, from traditional universities and institutes of higher learning to virtual organizations specialized in e-learning (Williams, 2003). Borderless education is increasingly viewed as being synonymous with online education at a distance (Kelly and Ha, 1998), the connected network significantly expanding the realm of learning while mobile technology makes learning more contextualized and free with location and time. As Cheng described in his paper, borderless learning aims to develop students' contextualized multiple intelligence (CMI) and creativity. It also creates unlimited opportunities for students' life-long learning through individualization, localization and globalization in the educational process (Cheng, 2002).

In fact, schools, colleges and universities have not been the only methods of education and training in the definition of learning. Learning opportunities occur at all ages and in numerous contexts: at work, at home and through leisure activities. A study by Vavoula (2005) of everyday adult learning found that 51% of the reported learning episodes took place at home or in the learner's own office at the workplace, i.e. at the learner's usual environment. Learning occurs quite often in informal settings.

Information Communication Technology (ICT) broke the barriers of location and changed roles (e.g. student, teacher, facilitator, learning coach and human resource or education manager) in learning activities. In informal learning, the range of learning objectives is not limited to curriculum in traditional educational institutes, but more to support every human in achieving her or his learning goals, respecting individuals' learning preferences in everyday life as well as organizational learning preferences (JISC, 2008). Like people embraced the Internet in their everyday life, exchanging global and international information, mobile technology further extends and meets the mobility needs of adults learning in a worldwide scope.

LEARNING IS CONTEXT-BASED, COMMUNICATIVE AND COLLABORATIVE
Learning is now regarded as a situated and collaborative activity (Brown, Collins et al., 1989). Learning can be flexible enough for the way knowledge develops and changes today by producing a map of contextual knowledge (Cormier, 2008).The principal pedagogical considerations to be taken into account are the urgency of the learning need, the need for knowledge acquisition, the mobility of the learning setting, the interactivity of the learning process, the situatedness of the instructional activities and the integration of instructional content (Chen, Kao et al., 2002). Learning may occur wherever people, individually or collectively, have problems to solve or knowledge to acquire, and mobile networked technology enables people to communicate regardless of their location (Sharples, Taylor et al., 2005). Vygotsky's basic mediational triangle is a model that states "any time a person or a group (subject) interacts with tools over time on some object with some shared motive to achieve some outcome, one can analyse their interactions as an activity system (Russell, 2002). Expanding on learning in institutional settings, recent investigations have been started in socially constructed learning, where learning community is the key point. Thomas states that "pervasive learning facilitated by mobile technologies offers flexibility to learners in terms of community, autonomy, locationality and relationality" (cited in Cobcroft, Towers et al., 2006). The mobile technology increasingly supports social interaction in learning through many communicative ways, for example SMS or text, voice and media facilities for interpersonal communications.

Meanwhile, the student now becomes the generator of knowledge and is able to collect, display, share and analyse multiple perspectives on issues and problems (Herrington and Herrington, 2007). Therefore learning can be need based among learners who generate knowledge by collecting and sharing through mobile and communication technologies in an online community. People work together using these tools to achieve particular outcomes in the community. As participants of a community, they accept particular rules, norms and divisions of labour (Engeström, 1999). Educational researchers (Brown, Collins et al., 1989) argued that students learn best when given the opportunity to learn skills and theories in the context in which they are used. Then they construct their interpretations of a subject and communicate those understandings to others. The form of an online mobile learning community, getting rid of limitations of location and time, includes knowledge generation in context, learners' experiences in the real world, the mediation of mobile technology for information and knowledge instant delivery, collaboration among learners and necessary guidance or scaffolding in the learning process.

China has become one of the top two countries of students studying abroad in the UK, Australia and the USA (Bishop, 2005; BBC, 2007; Government, 2008). In this research we selected Chinese young people, the new Chinese generation of new technology users, as our target group. Most of these people are current university students or just graduated. We examined these Chinese students, who are receiving education either in China or in the UK, about their learning experiences with mobile technology and implied the form of learning community across national borders which is supported by mobile technology world-wide.

IM AND MOBILE IM FOR LEARNING
As we mentioned before, social software together with mobile technology leads us into the new world of communication, getting, delivering and exchanging information and knowledge, which was called Mobile 2.0. Instant Messenger is social software for real-time communication between two or more people with online text. Mobile Internet is getting popular with students, as shown by the figure from CNNIC showing that 1/3 of young people, and especially 2/5 of current university students, have used mobile Internet in the past half a year (Zhou, 2009). Most of them started using mobile IM. Mobile IM transposes the desktop messaging experience to the mobile use in different scenarios. The majority of mobile IM users in China (42%) are young people aged from 18 to 24 (MMClick, 2008).

Two studies were conducted to find out how students use IM and mobile IM in their daily life, especially their initial innovation of using IM in learning. Participants in these two studies are young people, aged between 16 and 40, located in China. One study mainly focused on students' experiences using traditional IM tools; the other study was a survey on how young people using mobile IM.

Study on the use of traditional IM

17 undergraduates distributed in Chongqing, Wenzhou, Jinhua, Shijiazhuang and Shenyang were interviewed online about their IM experiences using QQ, which is the most popular IM tool in China (94% of IM users are QQ users) (IResearch, 2007). Our study found that students spontaneously used IM as a tool to aid their learning after school. According to the features of QQ, students delivered various kinds of files through it, including audio, image, video, program files and other documents. Their main motivations for using this IM tool for learning are:

- All students like the feature of 'group' in IM, which was set for special purposes, such as courses by subject, associations and clubs, and events announcements. They liked to share documents, photos, music and even videos by uploading files to the group space.
- They would like to discuss their coursework, problems they encountered and also their study and life experiences. They searched for help about their courses, announced events and entertainments, inquired on literacy and knowledge.

Learning with IM occurred mostly after class in their leisure time, but it was also related to their learning in the classroom. They exchanged ideas peer-to-peer or discussed in a group.

Study on mobile IM

Since mobile IM came to the market, it has become more and more popular among young people. We recently conducted an online survey among 93 people in Chongqing, Mianyang, Beijing, Shanghai, Jingdezhen, Hangzhou and Changsha. From this survey, we found that 63.5% of participants had ever used chatting with mobile IM through their own mobile phones, 21.4% of whom used mobile IM very often. Among those mobile IM users, 49.1% of them started using it more than one year ago. 58.5% of the mobile IM users remained online more than half an hour each time they logged in. Although 73.8% of them use mobile IM for leisure, 30.8% claimed they also used it for work or study. Separately, 41.5% and 30.8% claimed that mobile IM was convenient for them to keep in instant contact with friends and classmates locally and globally (in other cities and countries). 15.4% of mobile IM users stated that they use it for instant group discussion.

Implications of these two IM studies

IM is generally a single user centered tool for chatting, while students spontaneously applied it to learning. Mostly the learning activities are peer-to-peer or group discussion. This indicates that students mainly use IM as an inquiry tool or for collaborative purposes. Either the information searching or discussion in IM is more relevant to personal issues, originated by the person himself. Mobile IM greatly enhances the flexibility of this collaborative opportunity by connecting people wherever they are. There are potential demands for an online space for sharing information and documents within the person's contacts. A blog is another way of sharing information; in our mobile IM study, 58.1% of participants had their IM account coupled with their online personal space. Basically, IM is applied to learning in personal scenarios.

THE STUDY ON MOBILE GROUP BLOG

As most IM software is combined with free online space, we also investigated personal spaces, looking deeply into their thoughts, experiences and insights in everyday life. Blogs give voice to communities and encourage idea sharing (Consortium and Initiative, 2007). As we regard blogs as a reflective learning resource (Shao, Crook et al., 2007), we set up a mobile group blog for 12 current overseas students in Nottingham to explore the use of blogging through mobile phones for their transition experiences to learning and life a week after they arrived.

Research Methods

The study had two different groups of students. One group conducted mobile group blogging in Nottingham, making insights to study life in Nottingham, collecting, sharing and discussing what they found on the blog site. The other group of students was from South West university of China, browsing through what the first group collected and shared afterwards.

A group blog was established using WordPress with mobile plug-ins. 12 mobile phones with prepaid sim cards were distributed to 12 newly-arrived Chinese students (8 females, 4 males) in Nottingham. In this group, learners collected and generated information/knowledge in real world contexts, delivered and shared them through a web-based mobile solution and conducted reflections and discussions throughout the mobile group blogging process. They can access the website either through mobile phones (any phone with proper web browsers) or from desktop and laptop computers. The moblogging interface and the site of the mobile group blog were shown as below in Figure1.

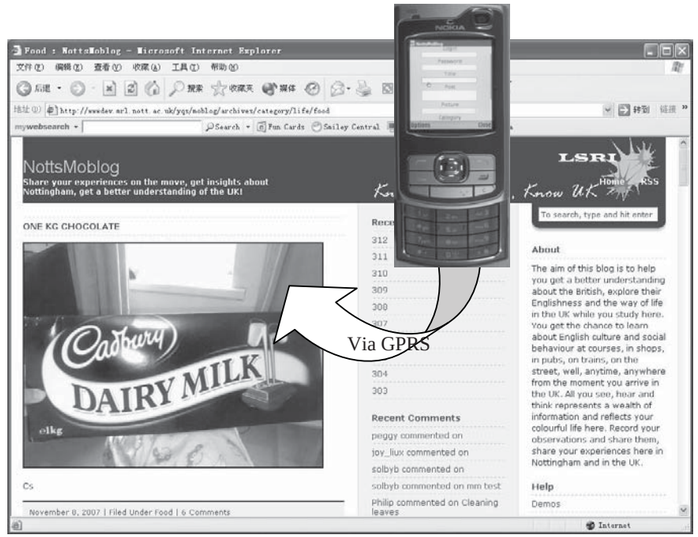

Figure 1. The mobile group interface

Reviewers from the other group in China included 7 postgraduate students and 16 undergraduate students who volunteered to read through those blogs and give their comments. The researcher sat beside them and made live observations, recording their talks during the reviews. Follow-up interviews and focus groups were also conducted with both groups.

Key findings

The main results include two main aspects in the research: one from a technology perspective and the other from the contents of those blog entries.

Technology

For all participants, it was the first time they used mobile group blogging. Most of them fancy updating to new technology in their life. They believed the mobile blogging kept their inspiration and enthusiasm for sharing experiences and feelings on the spot. Although this group blog also provided service for traditional blogging from desktop/laptop, the number of blog entries coming from mobile phones was 6 times of that of traditional blog entries. On average, it took them nearly one week to get used to the group blogging system, even if they were quite used to the use of their own mobile phones. This implicated that we should have necessary patience for people's technology adaptation. The cost of mobile blogging was one of the most important issues they were concerned about.

Contents

Current overseas students were happy to collect information about the host society, their understandings and their findings about the differences and particularity of host culture, proper behavior and the special and exciting moments they experienced. They also liked to share notices, experiences and knowledge about coping with people and solving problems with other student sojourners in the UK through this group blog, as they regarded it as an online community.

Prospective students who were still in China had their thoughts and knowledge about overseas life proved through the group blog, as they believed the contents of this mobile group blog were more authentic and true than other sources, like TV and information from agencies. Although they considered this mobile group blog could be more useful for current overseas students, these students in China still claimed the group blog filled the gap by offering them true stories of everyday life about overseas study rather than only institutional information now available in China.

Both groups could post comments to the group blog for discussion. One prospective student submitted a question about an image in the blog she couldn't understand and one of the current students replied, even though they didn't know each other. This small case implicated that the group blog community directly bridged two groups of students in different geographic locations. It is not only a community for current students locally sharing their contextual awareness, but other people could communicate through the online virtual community remotely across location borders like between China and the UK.

INITIAL FRAMEWORK OF A GLOBAL MOBILE LEARNING COMMUNITY

Implications from these two studies above showed great potential for a more flexible and just-in-time borderless learning market through a mobile online community. The interactions between learners in different locations can go

synchronously if the mobile infrastructure is better. Mobile IM emphasizes more on one person and their surrounding social network. Everything in mobile IM is initiated or derived from personal needs or requirements. Different from IM group sharing and the personal blog, the group blog specifically is set up for one particular featured theme. The discussions and contents of the group blog are always asked to keep to the point. Put in another way, everything in the group blog is initiated and developed from one specific topic or for a certain purpose. If the applications of mobile IM in learning are more spontaneous and self-motivated by individuals, the mobile group blog is more structured and featured for learning purposes. Therefore we would like to suggest and conclude features and factors could be included, but not limited to, in a mobile community for borderless learning based on these mobile IM and group blog studies.

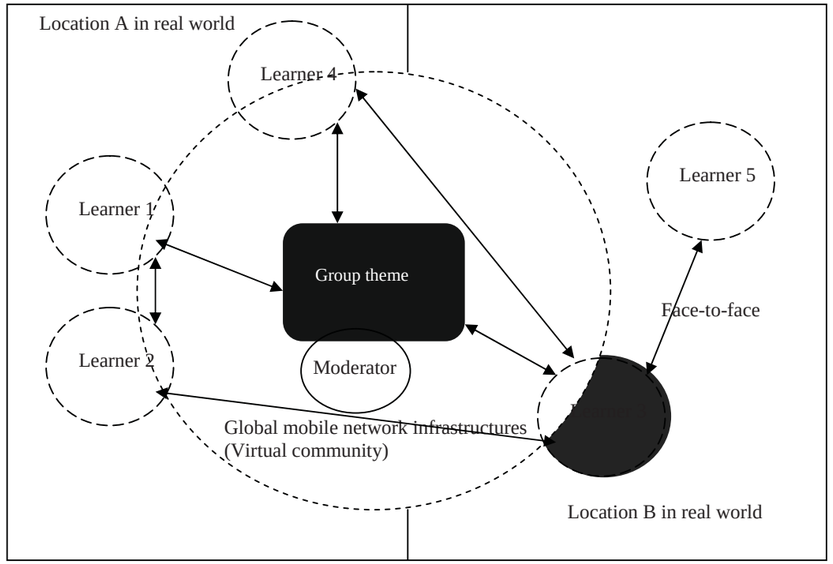

Figure 2. Framework of global mobile community for learning

We consider several basic elements in this global mobile learning community as follow:

Mobile devices and network infrastructure

The global network connecting countries all around the world provides the worldwide infrastructure of using mobile technology. High-quality hardware and software in mobile devices and computers, as well as good national cable and wireless network also have great impact on learning applications, especially on a worldwide scale. The following features of mobile technology and its globalization should be taken into account.

- Accessibility

The accessibility here includes access to the mobile device and access to the network. The main issue with mobile device usage is that difficulties of output like small screen displays and the difficulties of information input like the angular keyboard. Multiple assistive technology products have been used in making these mobile devices more accessible such as touch-screen, voice recording, text to speech conversion and zoom technology, allowing low-vision users to view magnified content. Also, the accessibility of software running at the mobile agent influences the users directly. The accessibility to the international network mainly stands for Internet access, currently operated mainly on the cable network, the wireless network and the mobile radio network.

- Connectivity

The network connectivity determines how successful mobile technology could be since the mobility relies heavily on the connection. Proper operation of the network also involves collaborations in different countries to offer good mobile Internet services, guaranteeing smooth data flow and signal coverage. The speed and expense for connections are also key points that mobile users have to consider. Facilitators and technologists are inevitable and essential, either to mobile devices or to the international network. Stable connection between devices and network infrastructure is also a positive support to encourage people using mobile technology for learning.

- Interoperability and device independence

Interoperability includes the operation across different networks and device systems. The compatibility of hardware and software between different platforms and applications in mobile devices decides the scalable capacity of each mobile solution. For most mobile devices, there are still no worldwide standardized regulations for developing mobile solutions.

This results in great diversity of hardware and software among mobile devices and mobile clients, which affects the generalization of mobile applications in learning.

- Convergence and diversity of mobile devices

Now a single handheld device can be a phone, camera, MP3 player, GPS, game console, PIM and overall super-gadget. Users can represent knowledge in different forms like photos, audios and videos. The astonishing growth in the number, types, novelty and complexity of mobile multimedia applications and services greatly increases representations of knowledge for learning. Obviously it also requires the capability of mobile networks to transfer the heavy flow of data. Meanwhile, diversity of mobile devices benefits individuals for their needs and preferences but brings trouble to designers and developers. Designing for all the diverse types of mobile devices is difficult according to the different platforms and standards.

The mobile infrastructure internationally provides most technical supports for the global mobile online community, which is essential and important. But for a community, humans are the key element. The technology-mediated community can't exclude the most important elements of humanity. The framework shows elements and relationships between them in such a global mobile community. In this framework, there are two correlated forms of units.

Units

In a community, three dimensions as the properties are mutual engagement, a joint enterprise and a shared repertoire (Wenger, 1998). Engagement, the process of negotiation and the creation of resources by people are the source of coherence to the community, which are more significant than technologies. Roles in this mobile community have some differences due to changeable contexts and the development of technology.

In the framework there are five states of learners, which were represented by learners 1-5, doing learning in different ways. Learners 1-4 are mediated by mobile technology and networks that can collect information and generated knowledge from real contexts. At the same time learners 1-4 form an online virtual community with the aid of mobile devices and network infrastructures. 'Learner 5' only learns in the real context and has face-to-face connection with 'learner 3.' 'Learner1' and 'Learner 2' have personal connections through the mobile network. Arrows in the framework represent connections between people.

Two forms of units exist in this community if we observe it from different perspectives. They are individual-centered units and group-organized units.

Units based on individuals

Learners are scattered in different locations but are connected with the mobile network. Take 'Learner 3' as the center of this community; he has several pathways to connect to other members of the community. Like the form of mobile IM, one person can collaborate and communicate with other learners in several different ways: face-to-face personal contact with 'Learner 5,' direct mobile technology mediated connections (e.g. mobile IM) with 'Learner 2' and 'Learner 4' and mobile technology mediated connections (e.g. mobile group blog) with the 'group theme.' Learning activities occur with the mobile technology mediated connections and communications are spontaneous and self-motivated. The individual learner is in the center of the relations, the center of the personal social network. Learning that occurs in this community may not be well organized and mainly spontaneous, self-initiated and personalized. Interactions and negotiations between this learner and his/her contacts are independent according to different purposes of communication. For peer-to-peer communication, both learners are highly engaged and the interactions between them often need to be instant and direct. In this individual centered unit, learning mainly happens by appeal to the demands of the individual learner.

Units based on group theme

The 'group theme' constitutes the purpose and regulations for grouping, which could be initiated by individuals, organizations or even just within friends (e.g. mobile group blog/forum). Taking 'group theme' as the center of this community, learners who are members of this group community are 'Learner 1', 'Learner 3' and 'Learner 4.' One extra role in this community is the 'moderator' to maintain and keep the communication on a certain point. Here in learning, the role of the moderator could be played by tutors, experts and even senior learners who have senior knowledge or skills. The moderator's task is to tailor the information and knowledge (learning resources) in the space that were contributed by learners in real contexts, giving scaffolding information or guidance to learners during the learning process. In this group-organized unit, more complex interactions among different people can be seen. Multiple channels of interaction and communication between group members are there. Both individual learning and collaborative learning could occur in the group theme. Negotiation between people becomes a bit complex compared to the individual unit, because more group members are involved. The center of this unit is the 'group theme,' which is not a person. The main reason to gather individual mobile learners together is learning for a specific purpose. The engagements of group members in this unit are relevant to the purpose of the grouping, the learning contents in the group and individual motivations. Learning activities in this group unit could be organized and probably scaffold or semi-scaffold, which depends on the learning purpose and how much the moderator is involved. The authentic collections from different group members through mobile devices in different learning contexts contribute to the constitution of sharable online learning resources.

Relationships between these two units

Different people are relevant to different units. The ‘group theme’ excludes ‘Learner 2’ although he is one personal connection of ‘Learner 3.’ This indicates that the personal contacts of one learner may not be his contacts of the community for a ‘group theme.’ He got new opportunities to know more people through the ‘group theme.’ The links of an individual’s social network may be overlapped with the links in the group. On the other hand, one learner (‘Learner 3’) may have a dual channel to contact with the other learner through both individual direct connection (like mobile IM) and connection through the group space (such as mobile group blog).

Learning objects

Information and knowledge from real contexts are the main resources of learning objects. Learning objects vary greatly between different people and for different purposes, but mainly from the learners’ personal experiences. Different from knowledge generated and delivered by experts, these learning objects mostly come from learners themselves. This potentially forces learners back to reality, building up their own knowledge or updating knowledge by understanding the real world. The representation of knowledge in all forms, whether or not in the form of multimedia, could be generated and interpreted through individual learners or by discussions and interactions among the mobile learners. What’s more, the learning resources in the community can be stored and kept online in an online space (such as a blog), or maybe tailored by the moderator. These authentic learning resources could also be reusable learning objects for new community members.

The advantages of this global mobile community

In fact, a real global mobile community consists of many sub-communities of these two forms.

Traditional learning is mainly the fact that learners get expert-generated knowledge from people or from different mediums such as books, journals and multimedia, etc. The mobile technology pushes learners back to the real world, fetching authentic objects and evidence to generate their own knowledge through their own understanding of real contexts. The community bridges the real world and the virtual world. The mobile devices and the network enable learners to learn anytime anywhere by getting, generating and sharing knowledge instantly and globally through possible collaboration and discussions.

CONCLUSION AND FUTURE WORK

Young people like students, growing up with new digital technology, show their enthusiasm to handle new mobile technology in learning. The mobility of students nowadays allows them to have more opportunities to break the barriers of learning in a fixed location, across regional and even national borders. Studies in this research explored the possibilities of building up a global mobile community for mobile learners to learn in context, communicate through mobile technology whenever and wherever they are located and discuss and reflect by sharing knowledge. The framework summarized from these studies is proved to be a possible and feasible model for learning in this global mobile community on the basis of the research studies. However it still takes time to explore more possibilities and features of learning in this kind of mobile global community. It also relies on continuous development of mobile technology; in addition, this community could be of assistance to current mainstream higher education, or it could purely be in the form of lifelong learning in everyday contexts.

In the next step, we intend to conduct new studies on student groups’ synchronous connection and communication for learning, comparing the differences and similarities between different sub-communities. We can foresee some difficulties and constraints due to infrastructures and time differences, even some unpredictable conditions we may have. But the reduction of cost is terrific in both countries and better infrastructure makes this possible and promising. We wish one day this ‘real’ borderless learning could benefit more people in their learning in institutes, after schools and even in their work and business, both in formal and informal settings.

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Innovative Mobile Learning Device: Greek and French Students' Perceptions

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ABSTRACT
In this article we investigate how university students are using handhelds and laptops for learning in formal and informal contexts, and which will be the ideal mobile learning device. By conducting exploratory research we focussed on students' perceptions related to the use of these mobile devices. The results of our research indicate that students would like to have a device which should be a perfect combination of both a PDA (personal digital assistant) and a laptop so that it can adapt to various learning contexts: at home, at university, at the library and on the go.

Author Keywords
Mobile learning, laptops, PDAs, formal and informal contexts, students

INTRODUCTION
We live in the technology and speed era. If some years ago mobile technology seemed far away, now everything has changed: we can hear everywhere about mobile, mobile devices, mobile learning, mobile education and mobile teaching. With the fast development of mobile technology people seem to realize the multiple opportunities they have by using it: cell phones, handhelds, MP3 players, portable game devices, tablets and laptops abound. Society has changed a lot: the education system, the teachers, the learners, the world, everything has changed. In such a demanding society mobile learning suffered many changes along the years. Baron affirms that for every technological trend there are three phases, corresponding to the progressive introduction of it into the educational system: innovation, incitation and prescription. Research is the first phase: innovators and researchers discover and invent possible educational instruments; in the second phase, that of development, new technologies are innovated and diffused: researchers, innovators and pedagogical militants elaborate new technical devices. In the third phase the instruments are mentioned in the educational programme; sometimes they are substitutes for old types of technology, and in this way a new type of technology is integrated in the educational system. Considering Baron's position we could say that right now we are struggling between the two last phases he proposed. We can split the evolution of mobile learning in three phases: the first phase concentrates on mobile devices (Sharples, 2000; Sharples and Beale, 2003; Sharples et al., 2009), learners, theories of mobile learning and contexts; the second one refers to designing mobile learning and the third phase brings a new level of maturity to the mobile learning landscape by creating a three level evaluation framework (Vavoula and Sharples, 2009). If in 2003, Tatnall and Davey see mobile learning as an innovation and he even gives some suggestions concerning how to overcome the difficulties in adopting it, 6 years later Kukulska-Hulme et al. (2009) present a European Perspective upon innovation in mobile learning, and Vavoula and Sharples (2009) add an evaluation framework for mobile learning. If in 2005 researchers were mentioning that the significance of mobile learning is mostly communication and not content oriented, in 2009 it become a priority to think about content and how we can adapt it to different mobile devices. Our research aims to provide the answer to the question asked by Kukulska in 2005: "what the ideal mobile learning device would be like" for students.

BACKGROUND
Chan et al. (2006) said that for 2016 "we anticipate that personal, portable, wirelessly-networked technologies will become ubiquitous in the lives of learners" and "one can find educators advocating everything from mobile phones and notebook computers to Tablet PCs and personal digital assistants (PDAs)." In the beginning mobile devices had not, as their main purpose, learning activities (Kukulska-Hulme and Traxler, 2005), however the multitude of features makes them suitable for such activities. There is a great diversity of mobile devices that can be used for educational purposes, among them there are: PDAs, mobile phones, game consoles, laptops, subnotebooks, ultra mobile PCs and so on. As Kukulska (Kukulska et al., 2005) says mobile devices "offer ways to complement, improve and enhance learning activities and processes by helping to overcome practical constraints and barriers."

The ubiquity of mobile devices and their penetration in our everyday lives is very well expressed by Wagner (2005):"Wherever one looks, evidence of mobile penetration is irrefutable: cell phones, PDAs, MP3 players, portable game devices, handhelds, tablets, and laptops abound. No demographic is immune from this phenomenon. From toddlers to seniors, people are increasingly connected and are digitally communicating with each other in ways that would have been impossible only a few years ago."

Along the years in the mobile device landscape there were not many changes. Sharples and Beale (2003) consider that there are six categories: wrist-worn devices, mobile phones, handheld computers and PDAs, web pads, pen tablet computers and laptops, while Corbeil and Valdes (2007) add to that list iPod, mp3 player, USB Drive, e-book reader, Smart Phone and Ultra Mobile PC.

Alexander (2004) envisioned that the mobile learning landscape was described primarily in terms of mobile laptops, "ranked as the most important hardware issue on campus today" (Green, 2004) and handheld computers (BECTA, 2003; Alexander, 2004; Trinder, 2005), and with Smartphones and 3G networks appeared a new potential for mobile learning that had to be explored (Wagner, 2005). "As these (mobile) devices become more powerful they may coexist or supplant other technologies to make learning more portable" (Corbeil and Valdes, 2007). Keegan in his article "Devices and technologies for mobile learning" makes a description of the perfect mobile device, but he says that this device should adapt to the kind of definition of mobile learning we are using.

As a result of our literature review, we have decided to focus our research on just three of them: PDAs, mobile phones and laptops.

Research proved along the years that there are many advantages concerning the use of PDAs for education. These easy to use instruments, even for genuine users (Smith and Kent, 2003), considered in the beginning as a novelty (Smith and Kent, 2003), are instruments for informal learning since there is freedom and control in accomplishing tasks (Sharples, 2007). Seen as "an increasingly compelling choice of technology for K-12 classrooms because they will enable a transition from occasional, supplemental use to frequent, integral use" by Rochelle and Pea (2002), instruments for increasing learning (Soloway et al., 2001) and productivity (Smith and Kent, 2003), PDAs encourage responsibility, communication, organization and collaboration, they support mobile computer literacy and they help continuity between contexts. They support flexible learning (Motiwalla, 2007) and ubiquitous computing by being user-centred in a computing environment and they support both formal and informal learning: field trips, museums (Cabrera et al., 2005). Owning these devices stimulates many activities.

They are good for lifelong learning, open and distance education (Sharples, 2000), collaborative learning (Rochelle and Pea, 2002; Cabrera et al., 2005; Zurita et al., 2003), as teaching support (Wishart et al., 2006). Kukulska (2005) suggests to just take advantage of the other PDA benefits - as tools: sharing content, annotating, listening to educational content, downloading information and Wishart et al. (2005) adds also accessing course related materials. They help relaxation through video, music, games (adapted after Trinder's scheme for uses of PDA, 2005). PDAs seem tools which can "feet to students' life" (Waycott et al., 2003).

Laptops are controversial devices since there are pros and cons concerning their mobility. Concerning laptops there is research done referring to their use in different contexts. Advantages in using laptops are communication, improvement of technology literacy, they enhance students' motivation and independence and they connect school and home universes.

Concerning mobile phones, Michell et al. (2005) used them to support ubiquitous learning. One goal was to deliver educational materials: a math trial, bug hunt and orienteering to Smartphones. Encouraging results have been obtained from this research. Houser et al. (2002) present students who use their mobile phone for practicing foreign language vocabulary. Concerns related to usability were just a few, instead it was discovered that cell phone e-mail produces learning superior to desktop email, mobile web and paper. Holzinger et al. (2005) explore the possibilities of using mobile phones for medical doctors and nurses. These devices, being so small, can be accessed anywhere and can provide valuable information when needed. The conclusion though is that to be successful for bed side teaching or problem based learning further exploration has to be done. Thornton and Houser (2005) present 3 cases of using mobile phones for English lessons: they can be used for exchanging messages, taking vocabulary lessons on their mobile phones and evaluating a web site explaining English idioms through the video capable mobile phones. There are positive results concerning the educational effectiveness. Some other researchers explore the potential of mobile phones for active learning in the classroom. Mobile phones seem to be a viable alternative preferable to the laptops. They can be used for sending SMS or MMS. The technical barriers which can appear can be overcome by testing in advance. Symbols entries are difficult to achieve and the cost of sending an SMS or a MMS is also an impediment. There are researchers also exploring the social uses of cell phones in Brazil. The study focuses on three main issues: appropriation of technology, the degree to which pervasiveness of cell phone transforms it into social collective technologies and digital divide through cell phone replacement.

Mobile phones are used for: communication (chat and e-mail), exchanging audio and video files, providing learning material, for quizzes and puzzles, Math and English language learning, improving literacy and numeracy level among learners, collaborative and project based learning, Internet browsing, connection with other devices, transferring data and ubiquitous learning. The mobile phone facilitates coordination between teachers and students (Katz, 2005).

They are not the best tool due to the still high cost of SMS and MMS, and in some schools they are prohibited. Browsing on mobile phones seems to be a difficult task since most web pages are not adapted to mobile devices. The life cycle of a

mobile phone is still low and the battery the same. There are issues related to security and there is not enough software developed for mobile phones. On the other hand, educators are confronted with difficult situations: interruptions and cheating (Katz, 2005), theft, misuse of camera and access of pornographic materials.

The survey done till now lead us to the following conclusions: there is a huge penetration of mobile devices; students like to use different mobile devices and they perceive their usefulness; there is a whole diversity of both formal and informal uses of mobile devices; and students, if possible, will prefer a single mobile device which can adapt to different contexts.

Though there is a lot of research done concerning uses of different mobile devices for different users in different formal and informal settings, there are not many studies concerned with the use of only one mobile device which can adapt to different contexts. Keegan is the one who gives some indications of such a device. The purpose of our research is to find out if such a miracle device is desired by students for their multiple uses and needs. Our target group, composed of students of different nationalities, had indicated that, if possible, they are willing to invest in only one mobile device which can satisfy their needs. Our exploratory study focused only on three mobile devices: mobile phones, PDAs and laptops.

METHODOLOGY

We present two cases of mobile learning focussed on the following issues: how university students use different types of mobile technology in formal and informal learning and how an ideal mobile device would look like in the vision of our respondents. The first case explores which are the representations Greek University students (GUS) have concerning PDAs for formal and informal contexts. The second case explores the uses of laptops in the same contexts. We have conducted an exploratory research study focusing on two devices: PDAs and laptops. In the first phase of our research we have conducted a literature review on mobile learning and mobile devices in order to identify the most popular mobile devices and the devices the research community is more concerned with. We decided to target PDAs in our first study as being highly portable, flexible, personal and the focus of many research projects worldwide. In the second phase we have conducted a research study on the perceptions, opinions and representations of second year Greek university students related to mobile technology: personal digital assistants (PDAs). One of the findings of the study, that PDAs are not popular among Greek students, combined with the fact that we wanted a more diverse and abundant student population motivated us to continue our exploration with new studies. The third phase consisted of a research study on the attitudes and representations of French social sciences university students related to mobile technology. The questionnaire allowed respondents to first choose the main mobile device used for learning. This research was conducted in the first semester of the 2007-2008 academic year. The results of this research: while just 20% of respondents (N=81) used a mobile phone for different purposes, more than 70% of our respondents used laptops for formal and informal learning, made us explore further on only use of laptops by Parisian University Students (PUS). It is important to mention that from 81 respondents just one used a PDA; another one used a Smartphone and a third an iPod. In the fourth phase we have conducted a research study on the attitudes and representations of the students of Parisian universities (PU) related to mobile technology: laptops.

FINDINGS

Representations

Zajonc (1968) mentions that the representation can be “a form of interdependence between cognitive elements which has effects upon motivation, attitudes, affects, behaviours and cognition.” Komis (1994) presents representations and usages of technologies. Komis affirms that it is difficult to give a final definition for the concept of representation. He takes into consideration the definition of representation offered by Linard: *a representation is an ensemble of processes and products.* For Komis (1994) there are three types of representations: basic representations, which refer to computer as a device, and more advanced representations referring to the ways of using it: as an instrument and tool. The first ones, the mechanical representations, are exterior to the subject and they refer to computer as a device and that subjects are not so great technology users; examples of this type of representation: “screen and a keyboard,” “a simple device,” “a complicated, useful and frustrating device.” The second and third representations are considered artefact representations. Computer in this case is a tool for different purposes: for communication, entertainment, relaxation or work, etc. This type of representation refers to the actual or potential use of the device. And the third representation of artefact: the instrument. In his article Komis (1994) tries to find 9-12 children’s representations concerning informatics and computers. His findings related to the representations of computers are very interesting. Children at this age see computers as an instrument for playing. Komis identifies five types of computer representations: as an instrument for playing, data saving, of the uses of computers; of computers as being part of the high technology; anthropomorphical representations of computers.

Since it is quite difficult to distinguish between the last two computer representations (Bruillard, 1997) as a tool and as an instrument, we choose for our article just two of them: a - one referring to computer as a device and b - the second one a representation of computer as a tool or instrument. We consider that the instrumentalization of computers is done through software which we can use, an idea expressed also by Baron and Bruillard (1996). In the table below you can see the representations students have referring to PDAs and laptops, and our hypotheses of representation. As a general observation we can say that many of our respondents have chosen the representation of PDA or laptop as a device.

		Respondents’ statements	Hypotheses of representation	Type of representation
PDA	1	Portable, small, usable	A small portable and usable device.	a
	2	Screen, stylus, touch	A device with stylus and touch screen.	a
	3	Forum, chat, note taking, small	A small instrument for forum, chat, note taking.	b
	4	Drawing, sound recording, music	An instrument for drawing and listening and recording music.	b
	5	GPS, 3G, touch screen	A device which has GPS, 3G, touch screen.	a
	6	Drawing, games and Word	A tool for drawing, games and Word.	b
	7	Internet, images, music	A tool for Internet, images, music.	b
	8	Personal, digital, portable	A personal, digital and portable device	a
laptop	1	Practical, fast, pleasant	The laptop as a practical, fast and pleasant device.	a
	2	Practical, vital	The laptop as a practical and vital device.	a
	3	Drog, time, virtual	An addictive device offering a gateway to virtual world.	a
	4	Stress, artificial, ephemeral	An artificial, ephemeral and stressful device.	a
	5	Communication, studies, entertainment: films, games	An instrument for communication, studies, entertainment: films, games.	b
	6	Working, programming, writing	A tool for working, programming and writing	b
	7	Software, files, accessing Internet	A tool for Software, files, accessing Internet.	b
	8	Tool, information, wifi	A wifi tool for information	b

Table 1. Examples of student representations for PDAs and laptops

Greek Vision

PDAs for university lessons

The analysis of student responses (N=80) to the question concerning the use of PDAs for university lessons offered us an interesting view. As a result of our research we have discovered that 90% of students consider PDAs useful for Art classes, 83,75% of students consider it useful for Math lessons, the same percentage vote for Physics, 81,25% plead for Geography lessons, since like one of our respondents mentioned: PDAs “can bring the world to your feet.” 82,50% of students would like to use the PDA during Greek lessons, though they signal some difficulties with the language and they would like to have more educational programs in Greek language. It is quite interesting that just 68,75% of the respondents find PDAs as a good instrument during ICT lessons. Concerning ICT, some respondents mentioned that they see PDAs as a good tool for exercising how to use technology and for learning different types of educational software. Since PDAs need special software, sometimes certain types of software are not accessible for this device. Exactly 68,75% of respondents see PDAs as a good tool for foreign languages since they can access all kinds of materials on the Internet, they can listen to different materials and they can record their own voice. 76,25% of respondents declare they see PDAs as useful for History lessons and 77,50% of respondents see it useful for Biology lessons.

How relevant are handhelds for the Greek educational system?

The analysis of the student responses (N=80) made us understand that 72,50% of the Greek students consider them relevant for the future. Some respondents consider that it is too early to introduce them in the educational system since “Greeks are more traditional” and they do not have the practice. Some other respondents underline the idea that this will be a next step in education because “first there is a need to have everywhere desktops and afterwards we will see about mobile technology.” Despite pros and cons, generally speaking the introduction of PDAs helps modernization, motivates students to learn, makes learning and teaching a much more interesting process and it improves communication. Another respondent views innovative uses of a PDA since it is “a very useful tool not only for the Greek educational system, but for other European systems since such an instrument is needed for learning and creation.”

Advantages and incovenients in using PDAs

One respondent is against using PDAs for lessons since it has “small screen and it is tiring for the eyes,” and that “there are many difficulties in terms of reading and writing,” while others are delighted exactly because of this. PDAs are “very small and very manageable, one can learn to use it easily, the small size helps to have everything with us and be regularly informed about educational developments.” One respondent is questioning upon the utility of PDAs and its negative effect upon the traditional way of learning “why abolishing the traditional way of teaching and learning as well as the interaction with the instructor?” Some others believe that the use of PDAs will give PDA addiction for students. Some other respondents believe that PDAs could help to have better lessons since they are similar in use with the desktop

computers: “I think the realization of this course using PDA would be very useful for students since the class will be more interesting and enjoyable and the process of learning will be more pleasant and creative. It could be useful in order to learn how to use internet and how to find the appropriate information that you want.”

Mobile Phones

Another phase in our research was to identify the most popular device used in France for both formal and informal education. We had 81 respondents, from whom just one used a PDA, another used a Smartphone and a third one an iPod. More than 20% of respondents used a mobile phone, but the most used mobile device for learning seems to be the laptop with more than 70% of respondents using this device for learning. The results obtained from this study made us understand that although mobile phones are widely used and the users are experienced (nearly all respondents had a mobile phone, but only about a fifth used it for learning), for the moment there is no significant educational use of them (from the point of view of common users): “This is an instrument indispensable for next years. At this moment I do not think that it is an instrument for learning; the main function is that of the phone” (female respondent, 25 years old). “The mobile phones are for me tools for communication, not for learning” (female respondent, 21 years old). “The utilization of mobile phones is still limited to communication” (male respondent, 30 years old). The only activities which seemed to be educational are: checking e-mails and printing documents from the mobile phone (used as storage device for learning materials). There is concern about health issues related with mobile phone usage.

French Vision

More than 88,50% from our respondents declare that they will miss not having a laptop, while 10,30% declare that they do not mind not having one. From our respondents (N=262), more than 90% have bought their own device. Just some of them have benefited from programme MIPE (Micro-portable etudiant), a programme addressing specially to students’ needs. Memory space is important for 24,1% of respondents, the battery is important for 20,30% of respondents and having a wifi connection is also a good asset for a laptop. It is surprising that for just 0,8% of respondents a web cam is important and the screen just for 3,8%. Taking into consideration the fact that for 2007 France was third place in having Internet connection, it is no surprise to discover that 80,2% of respondents declare that laptops serve as a device for connecting to the Internet while just 19,1% use it even if they do not have an Internet connection.

Advantages and inconveniences in using laptops

Our respondents appreciate the fact that the laptop is a portable, practical and fast tool both for their personal and professional life. It is an easy to use, simple and useful device. Its possibility of connecting both to Internet and wifi makes it useful in many contexts. It is a good storage device, as one of our respondents mentioned: “It is my life. I have everything on it.” Laptops are the most flexible, cost effective and powerful mobile devices used for learning. As with any device, laptops also have a list of inconveniences: the battery does not last long and it is still a heavy device. There are respondents who consider it a very stressful device since they are afraid that they can lose it or that they can lose their data. There are different health issues related to laptops: eye problems, back problems and stress. The noise made by laptops sometimes is very powerful and quite a big inconvenience. The need for a plug is considered quite a big disadvantage and the fact that you have to find room for it is not an easy task.

Figure 1. Respondents’ personal use of laptops

Personal use of laptops

Though we would have expected that students use their laptop mostly on the go or at the university, it seems that laptops are mostly used at home, the choice being motivated by the fact that at home there is Internet and a private space “where you can search whatever you want without being interrupted or taken by surprise by the others,” as one of our respondents mentioned. A big percentage of the respondents use laptops when they are on the move, especially at the library. At the university only 1,6% of respondents use laptops for entertainment. In Figure1 there is a visual representation of the respondents’ personal use of laptops. Internet use is in first place, followed by entertainment: music, photos, movies, games; communication: msn, chat, e-mails; Skype and research.

CONCLUSIONS

The purpose of this article is to explore and understand the opinions, representations and perceptions of university students concerning mobile technology. From the numerous devices used for mobile learning we have studied PDAs and laptops. These choices were driven at first by literature and subsequently by the results of the various phases of the research. The scope of our research included two complementary studies with students from two European countries: Greece and France. The two main studies complete each other and made us understand students’ representations about mobile technologies. Moreover, they gave us great insight into what students want and need as mobile technology

support for their activities, both learning and others. We hope that our results presented here are a close image to students’ highly mobile and diverse lives. As we stated above we face complementary results.

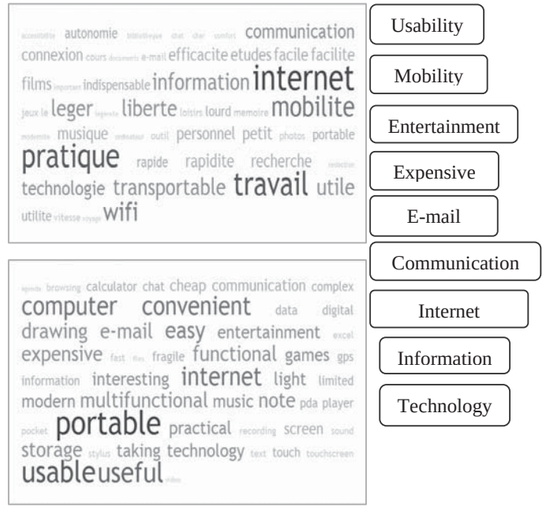

Figure 2. Greek and French students’ representations concerning PDAs and laptops

The two technologies explored are desired by students and fit their needs, though in different contexts. As we can notice in the two figures students’ representations concerning PDAs and laptops have many common points, backing up our opinion that a laptop is a device for mobile learning. The governing concepts are around information and communication, mobility and ease of use, work (in student terms that is learning related activities) and entertainment (mainly media playing). While in the PDA study the respondents like the device’s compact form and abilities, they still feel the need of a more powerful technological “friend” to help them out – a laptop, or ideally a mobile computer that has the form of a PDA but the abilities of a laptop. On the other side, the respondents of the laptop study feel somehow satisfied with their laptop, but they would like a lighter device if possible to be used on the go. Ideally they want a laptop in a smaller dimension, with longer battery life and that is less fragile. In Figure 2 we present visual representations of both Greek and French students and we have extracted the common features for both devices: laptops and PDAs.

As students’ lives are flowing in mainly four contexts: home, university, library and on the go, they usually have a laptop, a media player and a mobile phone, and they combine these devices in order to fulfil their needs in these typical contexts. The PDA is a desired asset, or better said they would like ONE device that can adapt to every context and to fulfil their needs in a satisfactory way. After analysing the data and speaking with our respondents, our understanding is that a small factor device with similar functionality to an ultra-mobile PC and a set of suitable accessories would be maybe the best bet for happy mobile learners. It is now time to finish with these everyday scenarios:

“I was sitting down with my personal devices, wondering which ones I should carry around with me. I have an Apple PowerBook G4, my Kodak L753 Camera, my IMate SP3 Phone, my Apple iPod Mini 4GB and my Maxtor 200GB Hard Drive…..exhausting isn’t it. Add to this the next connectedness…I am simultaneously connected by Wireless 802.11G, ADSL2+, Bluetooth, GPRS, Infra Red, USB2, my headphones and good old fashioned Broadcast TV tuner” (Keough, 2006).

Having only one device would simplify students’ lives: no more synchronizing devices or recharging many devices. We have drawn from students’ representations and opinions the robot portrait of the mobile learning device of tomorrow. This device is lighter than a laptop and the best match would be an ultra-mobile PC with cell-phone functionalities. It should have the ability to connect with a docking station for home context; use as is for on the go time; for times at university or library, or in any context where better input and display capabilities are necessary, we propose to have a foldable screen, a foldable keyboard and mouse as accessories. The only problems we face are the price and the foldable screen. Foldable screens will probably arrive soon, considering the advances in e-paper development. As for technology, the price is going steadily down. In university or library settings, normally students need better displays (but not necessarily true colour, just bigger and more readable), keyboard and mouse to be able to type reports/notes and read digital materials. This scenario will come to life in the very near future since this type of foldable technology already exists. The question is how long it will take to be part of our daily lives.

This study gave us an interesting insight in what mobile learning really means for students from two different countries and from different cultures. Though due to different constraints we were not able to make a deeper research, the issues we have discussed along this article are still open. As years pass mobile technologies are continually evolving and it becomes a necessity for all educational systems to adapt to this new type of learning. As our study has proved, students are welcoming such a great change: their attitudes and perceptions are positive. Future concerns should be around the following issues: what kind of mobile device is better suited for our students; what type of content should we deliver; how can we better prepare our professors for teaching with mobile devices? Which are the digital and mobile competences that both learners and teachers should have in order to fully benefit in their learning process?

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MobileMath: A Mobile Learning Application for Learning of High School Mathematics in the Caribbean

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ABSTRACT
This paper presents MobileMath, an m-learning application designed to motivate high school students to perform better in Mathematics. Failure rates in Mathematics in the Caribbean are very high and it is important for students to pass Mathematics in order to pursue higher education or take up a job. MobileMath has several features to encourage the learning of Mathematics. These include Lessons, Quizzes, Fun Facts, Examples and a Game that can be played between two students on different mobile phones. The results of a preliminary study with MobileMath are positive and reveal that students are very pleased with the application. The students indicated that they would use the application on a regular basis when it became available. The paper also discusses future research and development with MobileMath as a vehicle to improve the performance of high school students in Mathematics.

Author Keywords
Mobile Learning, Mathematics, Algebra, MobileMath

INTRODUCTION
MobileMath is the focus of our research, which aims to improve Mathematics performance by using Mobile Learning to motivate the learner, encourage the learner to practice and inspire them to work harder. MobileMath also attempts to change the students' attitude towards Mathematics by sharing some fun facts. Attewell (2005) observes in her study that learners were excited to use the mobile devices. Faux, McFarlane, Roche and Facer (2006) note that the pupils had increased self esteem, motivation and improved their ICT skills. The mobile phone is believed to motivate the user to learn, because most students today have a fascination with mobile phones and they are very familiar with this technology. So why not try to turn this familiar technology into something they can learn from? Sharples (2003) suggests rather than seeing them as disruptive devices, educators should seek to exploit the potential of technology children bring with them and find ways to put them to good use. The users are motivated by using fun and interesting features that give them control of their learning. This study will also try to determine if mobile learning is suitable for Mathematics.

Mobile Learning is used to improve Mathematics scores in a developing country because of its affordability and the motivation it can create. This paper describes a preliminary trial conducted to get an idea of students' reactions towards MobileMath. This study attempts to determine if students want to use it and whether or not is it easy for them to use. It shows evidence that students are excited and willing to use MobileMath. Using a combination of Mathematics lessons, quizzes, collaboration, mo-blogging, reminders, Bluetooth games, examples and fun facts about Mathematics, the MobileMath application encourages the students to learn and creates a more positive attitude towards Mathematics, resulting in improvement in their Mathematics performance.

BACKGROUND

Poor Performance in High School Mathematics
High school students throughout the English-speaking Caribbean typically sit the CSEC (Caribbean Secondary Examinations Certificate) examinations administered by the Caribbean Examinations Council (CXC) after five years of schooling. However, a large percentage of them are failing Mathematics each year. In 2008, 53% of the candidates in Trinidad and Tobago failed Mathematics (CXC, 2008). In 2008, 63% of the candidates from the rest of the Caribbean region failed Mathematics (CXC, 2008). In 2007, approximately 66% of the candidates failed Mathematics. This was a 2% increase from 2006 (CXC, 2007). Mathematics is a minimum requirement to obtain a job and it is also necessary for entry into almost any tertiary level educational institution.

Table 1 below gives more detailed statistics of the performance of students in the CXC Mathematics examination (CXC, 2004 - 2007). Paper 1 is a multiple choice paper testing breadth of knowledge, and students generally perform well on this paper. Paper 2 is a written paper designed to test depth of knowledge and mathematical skills. As can be seen from the table, about 20% of the students have been passing this paper over the last four years. This indicates that most students writing the examinations do not have a deep understanding of a large portion of the Mathematics curriculum.

The goal of our research with MobileMath is to devise strategies using mobile learning so that there will be a significant improvement in performance in Mathematics at the secondary level.

CXC Pass Rate: General Proficiency Mathematics Exams (Average score Jan. and June exams)		
Year	% students passing Paper 1	% of students passing Paper 2
2007	60%	20%
2006	47%	20%
2005	71%	20%
2004	78%	21%

Table 1. CXC Results in Mathematics for the Period 2004 – 2007

Mobile Phones Usage in the Caribbean
The prices of mobile phones have drastically decreased in recent years in the Caribbean and throughout the world. With the liberalization of telecommunication markets across the Caribbean, the cost of owning and using a mobile phone has dropped significantly, sending market penetration to an unprecedented high. Almost everyone has at least one mobile phone and many persons even have two.

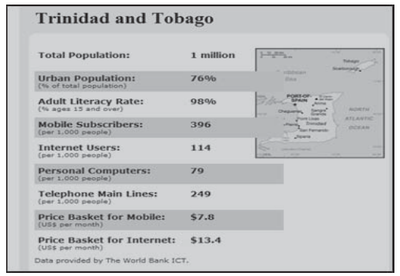

Figure 1. Statistics of Trinidad and Tobago on Mobile Data

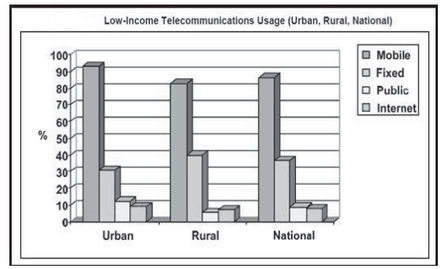

Figure 2. Telecommunication Usage in Trinidad and Tobago (Mallalieu and Cambridge (2007), page 4)

Figure 1 was taken from the Mobile Active web site (Mobile Active, 2009). It shows that the number of mobile users is more than three times the number of users of the Internet. Also, the number of mobile users is five times the number of people who own personal computers. According to a study done by Mallalieu and Cambridge (2007), mobile phones are currently the main form of telecommunications used by the low income population. This is shown in Figure 2. The evidence shows therefore that the mobile phone is an affordable technology for the low income population in Trinidad and Tobago and the wider Caribbean.

Problem Statement
Many teenagers today are very familiar with mobile phones. Most of them own a mobile phone of their own. Teenagers and young children seem to have a fascination with mobile phones. They spend as much time as they can on mobile phones playing games, communicating with friends, playing music, connecting online and using many other entertaining features. Therefore, if teenagers are so fond of mobile phones, they may be motivated to use these mobile phones to do school work if this work is presented to them in an appealing way. According to a study done by Perry (2003), schools unanimously declared that their learners were excited and highly motivated when they began using the handheld devices for learning. Attewell (2005) also finds using the mobile phones can cause students to be more motivated about what they are learning. It also builds self esteem and confidence using technology.

In our research, we hypothesize that a mobile learning application, if appropriately designed, can improve performance in Mathematics at the high school level in the Caribbean. The technology is widely available throughout the Caribbean and if students are motivated to use the technology, we believe that gains in learning of Mathematics can take place. However, the challenge is to design the application to motivate students and force them to exercise higher order skills. A

related research effort is currently taking place with the K-Nect project in North Carolina to address problems in Mathematics performance at the 9th Grade (K-Nect, 2009). This project is creating mobile resources for at-risk secondary students to focus on increasing their mathematics skills by the use of mobile smart phones.

METHOD

We have developed MobileMath as a Java MIDlet application. The application is designed to motivate secondary school students to review algebraic lessons and practise algebraic exercises. The intention is for this practise to lead to an improvement in the performance of Algebra. The application consists of the following components; Lesson, Quiz, Fun Facts, Examples and a Bluetooth Game. The main menu of the application is shown in Figure 3. Table 2 shows a list of the topics from the curriculum that is being addressed in MobileMath. The first version of MobileMath discussed in this paper deals with topics 1 through 10.

1. Using a symbol to represent a number	12. What is an Algebraic Expression?
2. What is an algebraic equation?	13. Directed Numbers
3. Substituting a number for a symbol in an algebraic expression	14. Adding algebraic terms
4. Subtracting algebraic terms	15.Adding and Subtracting algebraic terms
5. Multiplying algebraic terms	16. Dividing algebraic terms
6. Multiplying and Dividing algebraic terms	17. Using the distributive law
7. Expand brackets	18. Factorization
8. Finding HCF from algebraic terms	19. Using HCF to factorize
9. Factorization by Grouping	20. Addition of algebraic fractions
10. Subtraction of algebraic fractions	21. Multiplication of algebraic fractions
11. Division of algebraic fractions	22.Solving simple equations, one unknown

Table 2. Curriculum Topics Addressed in MobileMath.

Lessons

The Lesson feature offers several lessons on the introduction to algebra. Each lesson is short, only 1-2 screens in length, as it is intended to be a review of work already done in class. A student can use the lessons to quickly review concepts previously covered by the teacher in class. Students using MobileMath have all of the lessons at their fingertips and can use them at anytime. Figure 4 shows an example of one of the lessons available.

Figure 3. Main Menu.

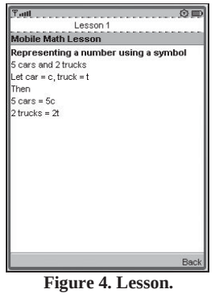

Figure 4. Lesson.

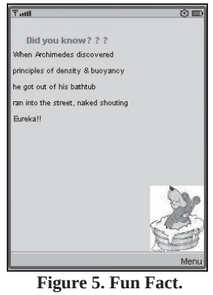

Figure 5. Fun Fact.

Quiz

The quiz consists of multiple choice type questions, to make it easy for students to enter the answers. Each quiz contains 10 questions. The students can use this feature at anytime for self assessment. At the end of the quiz the score obtained by the student is displayed. The quiz was created for the students to see their progress and as a method of encouraging them to do more work.

Fun Facts

The fun facts display an interesting fact about Mathematics as shown in Figure 5. The purpose for this feature is to show students that Mathematics is both fun and interesting. Also, fun facts are used to show some applications of Mathematics since most students complain they do not understand why they have to do Mathematics. It is intended to change the students' attitude towards Mathematics and to help them realize that Mathematics is essential to their lives.

Examples

The Examples feature shows the working and answer to several algebraic problems. The examples implemented in MobileMath are substitution, factorization, solve equation and several simplify expressions for algebraic addition, subtraction, multiplication and division. It also gives students the freedom to change the number values in the equations. By selecting the *Solve* option the students are able to see how the working and answer are dynamically modified to suit the new numbers entered. Figure 6 shows a Solve Equation example, in which a student can change the values in the boxes. We believe that seeing the working change for different numbers would encourage deeper understanding of the example rather than seeing it with one static value.

Game

The Bluetooth game is shown in Figure 7. Two students play the game from their own mobile phones. They have to set up the Bluetooth connection first and then they can play. During the game, each player has to answer a multiple choice question and if correctly answered that player is moved a random number of spaces towards the finish line. Bluetooth is used to send the data to the other mobile phone in order to reflect this player's movement on both mobile phones. The player who gets to the finish line first wins the game. Figure 8 shows a question which had to be answered correctly to be able to move towards the finish line of the game.

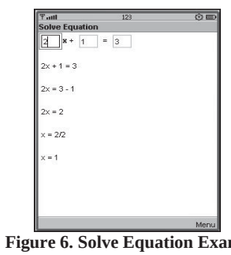

Figure 6. Solve Equation Example.

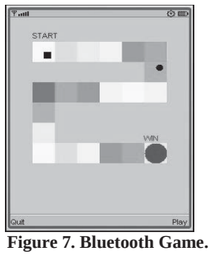

Figure 7. Bluetooth Game.

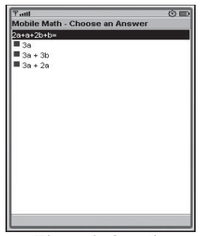

Figure 8. Question.

The purpose of the game is to create a fun way for students to practice algebra. We believe that if the students are having fun they will be motivated to work harder to win the game and ultimately learn more. The idea for this game was developed by the first author in a real high school setting. Here, a physical board similar to the one in Figure 7 was used. The students of the class had to answer a question and move along the board towards the finish line. The students in the classroom enjoyed this game tremendously. It influenced them to work harder in order to win the game. Parson, Ryu and Cranshaw (2007) propose a framework for mobile learning applications which utilize games. Also, instant feedback lets the learner know what they have achieved immediately. Using games for learning is currently an interesting research area and researchers such as Ketamo (2002) have used games to promote learning in geometry.

RESULTS

A study was recently conducted with MobileMath in Trinidad and Tobago with 11 students in which they were introduced to the mobile learning application. The students were from different levels at high school (know as *forms* in the Caribbean). The sample population is shown in Table 3.

Form	Form 2	Form 3	Form 4	Form 5
Number of Students	1	2	4	4

Table 3. Level of Students Participating in Study.

The students were at different levels of knowledge of algebra even at the same form, as evidenced by a pre-test conducted immediately before they started using the mobile application. However, as shown in Figure 9 below most of the students were quite familiar with the algebra used in the MobileMath application. They all attend different public high schools. The students were randomly selected from a private school where they took lessons on afternoons and weekends. The students have a perceived need for further help and support in Mathematics since they take these classes in addition to their normal classes at high school.

The preliminary study was intended to gauge the reactions of the students towards the MobileMath application. We had no idea how the students would react to the application, given the limitations of the device (such as a small screen) and the fact that they never used technology for learning Mathematics. On the day of the trial they were first given a simple assessment to get an idea of whether or not they were familiar with the curriculum topics implemented in the MobileMath application. They were then given a brief overview of the application. The students were allowed to explore each of the features of the application. At the end they were interviewed. For each feature of MobileMath they were asked the following:

- If you had this feature of MobileMath available on your phone will you use it, if yes how often on a scale of 1-5? Where 1-never, 2-once a month, 3-once a week, 4-once a day, 5-several times a day.

- How much did you enjoy using this feature on a scale 1-5?
- When you saw the menu how well did you understand what was required on a scale 1-5?
- Do you think you can learn from using MobileMath over a period of time?
- What feature of the MobileMath did you enjoy using the most?
- Was there a particular feature of the MobileMath that you found was difficult?

The first three questions were also asked based on the MobileMath application as a whole.

Figure 9 shows the students' performance in the assessment given. It shows that most of the students were familiar with the level of algebra used in the application.

Figure 9. Assessment Scores.

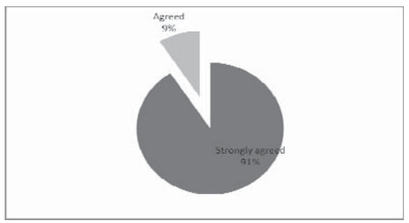

Figure 10. Software was easy to use.

Figure 10 shows that most of the students strongly agreed that the software was easy to use despite the limitations of navigating the buttons on a cellular phone. Almost all the students used the application with no assistance. They knew exactly how to get into and out of each feature and had no problems navigating from one screen to the next.

10 out of 11 students strongly agreed that they would use the application several times a day if available on their phones. 10 out of 11 strongly agreed that they could learn from the application if used over a period of time. All of the students agreed there was no feature that was difficult for them. All of the students who took part were quite excited while playing the Bluetooth game. Most were also very excited when they realized they could change the numbers in the examples feature. They liked having the control that this feature provided. This corroborates the study of Facer et al. (2004) where, in the proposal for Savannah, they noticed students needed to be in charge of their own learning given mobile devices to play the role of lions.

Figure 11 below shows the features of the application which the students enjoyed the most.

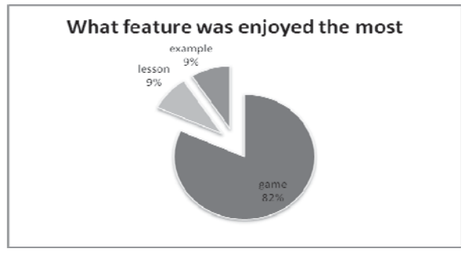

Figure 11. Overall, what feature of the software did you enjoy using the most?

For each feature of the MobileMath application the students were asked how frequently they would they use it if it was available on their mobile phones. Figure 12 below shows the result.

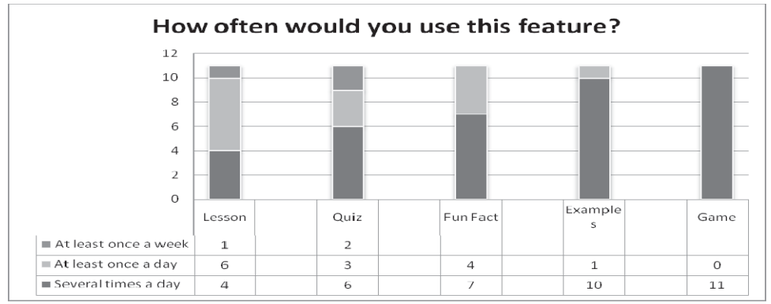

Figure 12. If you had this component available on your phone will you use it? How often?

According to Figure 12, most of the students agreed that they would use the game, examples and fun facts several times a day. In general the students enjoyed using MobileMath. They agreed they would use it on a regular basis if available. They all used MobileMath with no problems after having seen just a quick overview.

RESULTS DISCUSSION

In Trinidad and Tobago, there are often strict rules about the use of cell phones in schools. Thus, it was difficult to get permission to conduct a study in the public schools. The sample population was taken from a small private school and was too small to be statistically relevant. However, the purpose of the preliminary study was to get feedback from the students on the MobileMath application and to know if students at the secondary level would be willing and eager to use the software. We wanted to know if the students would find the application easy to use, if they enjoyed using it and if they would use it on their own phones on a regular basis.

The results showed that most of the students found the application very easy to use. This suggests training may not be required for this target group on mobile phones. They enjoyed using the application and it seemed to motivate them. They agreed they would use it as frequently as several times a day if they had it available on their own mobile phones. The results show that the MobileMath application was received very positively by the students. This indicates that the MobileMath application with enhanced features may be able to address the problem of poor performance in Mathematics at the secondary level. Based on these preliminary results we are now planning to move ahead by implementing more functionality in MobileMath and conducting tests with a bigger sample of students in Trinidad and Tobago.

FUTURE RESEARCH

Next Steps with MobileMath

The next step in our research with MobileMath is to provide more functionality with greater appeal to students and investigate longer term effects of the system with students. We will attempt to show that the MobileMath application can help students to improve their Mathematics scores in high school. We intend to conduct a second study with approximately 20 students at the Form 2 level. These students will use the enhanced version of the MobileMath application on a mobile phone for about three months. This level was chosen because the students would have normally done the curriculum topics at the previous level (Form 1) in their school. The students will be given a standardized test at the beginning of the study period to evaluate how much they know. The revised version of MobileMath will target the full set of curriculum topics shown in Table 2. The lessons, quizzes and the game will all be based on these topics.

We are hoping that with appropriate clearances from the Ministry of Education, the students will be able to use the mobile phones while in school, for example if a teacher wants to use the quiz or examples feature with the students in the classroom. However, it is expected that a significant portion of students' interaction with MobileMath will be outside of school. Thus, we intend to use GPRS for the students to communicate with the system. GPRS will be used to send lessons, quizzes and fun facts to the mobile phones during the week. A lesson will be sent 4 times each week to the mobile phones then an assessment will follow at the end of each week. Marks will be allocated to each student for correct answers given which will be stored in the server. The purpose of these marks is to keep track of the students' progress during the study. The quiz and examples will encourage them to practice concepts learnt.

The students will also use GPRS to communicate with the other students participating in the study. This is to encourage collaboration as many studies have shown that students learn a lot from collaboration. For example, Walker (2006) conducted a trial where they used the recording feature of the mobile device to record conversations of collaboration between the students. They recorded the collaboration in order to analyze it later because many important ideas many have arisen from the collaboration. Benta, Padurean & Cremene (2004) propose a multimedia m-learning application that combines the advantages of text, images and sound where there is a chat feature available to encourage discussion. By encouraging discussion the students would learn from each other. Sharples (2007) discusses the AMULETS Projects

where students were encouraged to collaborate to share information. The students collected data then shared with each other any ideas that were generated in order for them to learn from each others' ideas.

At the end of the three month period, the students will undergo another standardized Mathematics test in algebra to assess the progress made. These marks will be compared to the marks of the first standardized examination. Questionnaires will be used and interviews will be conducted with the students, teachers and parents. This study will attempt to determine if MobileMath has indeed motivated students to learn and perform better in Mathematics. It also intends to discover problems which may deter students from maximizing the use of MobileMath.

Features to be Added to the MobileMath Application

We intend to enhance MobileMath with the following features.

1. *Collaboration:* Students will be able to communicate with each other in order to collaborate on lessons and quizzes. The students are encouraged to collaborate and share their work as students can learn a lot from each other. Students will also be able to communicate with the teacher. This is essential for students who may be having difficulties or for those who may be too shy to ask questions in front of the whole class. They will be using GPRS and a simple Chat application for mobile phones like g-talk.

2. *Bluetooth:* This allows communication in class and the sharing of files, example lessons, music and pictures. It allows communication for the Algebraic game, where two students can play the game on their own mobile phones. The game will be improved; more features will be added to keep the students' interest. The path will be made more complex and when the students land on certain spots they will be given a bonus. Students who win games will be allocated extra points to be added to their final scores on the server.

3. *Feedback:* The teacher will be able to send feedback on quizzes and congratulations to students with good scores. Graphical analysis of the class performance will also be sent to the student. Feedback is important to let the students know that their efforts in algebra are paying off or to inform them of areas they may need to work on. Good feedback may even be the source of motivation to continue learning algebra and improving performance.

4. *Collaborative Quiz:* A quiz that is run every Saturday on the mobile phones. Only those students who are online can take part. The students will belong to one of four groups. In each group, the students in that group will be able to view the same question. Any member of the group can answer the question. The students can also communicate via a GPRS chat service to discuss the questions. They can toggle between the question and the chat. Once the question is answered by anyone from the group, the group's members all move on to the next question. This quiz is evaluated on a group level. After the quiz, the scores and the correct answers are sent to the students. They purpose of this feature is to get the student working together and as a result they can learn from each other.

5. *Mo-blogging - MobileMath Post It:* Students will be able to post their ideas from their mobile phones to a Web page. They can share lessons learnt, questions, suggestions and other information with the class. High scores from the last week of quizzes and the game will also be posted up to motivate the students. Accessing the web page will be done by a computer. This web page is for the students to have somewhere to display lessons learnt, share ideas with each other, to see the progress of their studies as time goes along.

6. *Reminders:* Students will be sent timely reminders to review the lessons and to alert them of upcoming quizzes. This is intended to gently encourage the students to get the extra work done.

CONCLUSIONS

This study is the first of its kind done in Trinidad and Tobago in Mathematics. Most of the studies previously done in other parts of the world have focused mainly on high end mobile devices like PDAs. This study focuses on using a mobile phone that the average user may already own, one that they can afford. MobileMath, an application with several components targeted at the learning of high school algebra was developed and introduced to students who agreed they would be willing to use it frequently. The study has shown that students in a developing country are excited and motivated to use the mobile phones to learn Mathematics. The next step of this study is already being planned. This involves developing an enhanced version of the MobileMath application and testing its long-term effects with students.

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A VoiceXML-Based Mobile Learning System and Its Caching Strategy

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ABSTRACT
Employing the technology of the Voice eXtensible Markup Language (VoiceXML), an open VoiceXML-based Mobile Learning System (VMLS) is constructed; its hardware and software system structure design is achieved. Aiming to address network delay, the key problem existing in VMLS, an adaptive Markov prefetching algorithm shared by multi-users and a more efficient caching replacement strategy are provided, which can improve the forecasting accuracy rate and the overall performance of cache system. The research results could not only be used in VMLS, but also could be used in other voice-based application system.

Author Keywords
VoiceXML, Mobile Learning System, Caching Strategy

BACKGROUND
With the fast development of mobile communication and the popularity of its equipment, an entirely new leaning style has come into being, namely Mobile Learning (Clark, 2003; Keegan, 2004). It enables anybody to learn anytime and anywhere according to his needs. It takes on various forms, including personal or laptop computers, PDAs and mobile phones.

However, there are still many new problems concerning Mobile Learning in our country. Though the popularity of the new technology provides a wider scope for the development of Mobile Learning, there isn't a practical and widely-used Mobile Learning System in existence because of many factors, including the variety of mobile equipment and its functions, limited capability, slow internet speed, small screen size, low storage capacity, and the high cost of communication in China.

Voice is one of the most important and effective communication methods between people. Voice communication is the most common application of telecommunication services. It has many advantages such as easy operation, high capability of adaptation, promptness and convenience, security, and low cost. It is very suitable for fragmented learning in mobile situations (Waycott, 2001; Waycott et al., 2002). So it's the best solution to Mobile Learning in China, which can be widely used. In particular, with the continuous decline of charges for telecommunication services, it can be expected that more and more people will enjoy the services provided by a Mobile Learning System.

As is stated above, based on the detailed research on Mobile Learning and voice communication, the paper provides a VoiceXML-based Mobile Learning System (VMLS), and perfects its design of structure and function. It also discusses the key parts and algorithms in this system.

The remainder of the paper is organized as following. At first the detail of VoiceXML technology is introduced. Secondly, the framework of a VMLS is described and a caching strategy in the VMLS is presented. Finally, a concise summary and future works are given.

VOICEXML TECHNOLOGY
VoiceXML is an XML-based language of the W3C to create voice-user interfaces, particularly for the telephone; the latest version is available at http://www.w3.org/TR/voicexml21 and is designed to create audio dialogs. Its major goal is to bring the advantages of web-based development and content delivery to interactive voice response applications. VoiceXML describes the human-machine interaction provided by voice response systems, which use automatic speech recognition (ASR) and touchtone (DTMF keypad) for input, and pre-recorded audio and text-to-speech synthesis (TTS) for output. It can record spoken input and telephony features such as call transfer and disconnect.

The XML root element of a VoiceXML file is <vxml>, which is mainly a container for dialogs. There are two types of dialogs: forms and menus. Forms present information and gather input; menus offer choices of what to do next. The definition of VoiceXML is according to the XML Schema Language XSD, available at http://www.w3.org/TR/voicexml21/vxml.xsd.

VoiceXML is a key used to transfer text to speech or database entries to speech in a very flexible way. Any text with its index of contents can be transferred from a document file into forms and menus of VoiceXML files that can be read out by text-to-speech synthesis tools.

Figure 1 shows the core architecture of VoiceXML applications.

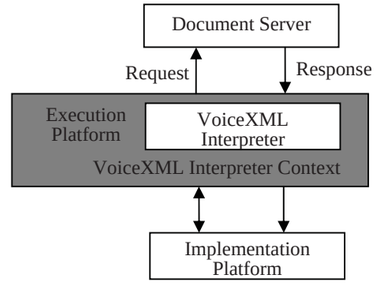

Figure 1. Architectural Model of VoiceXML

A document server processes requests from a client application, the VoiceXML Interpreter, through the VoiceXML interpreter context. The server produces VoiceXML documents in reply, which are processed by the VoiceXML Interpreter. The VoiceXML interpreter context may monitor user inputs in parallel with the VoiceXML interpreter. The implementation platform is controlled by the VoiceXML interpreter context and by the VoiceXML interpreter.

VoiceXML-based applications can be used through computers at home or in the office, but also through the telephone without any computer on the part of the user. Using VoiceXML we can bring much more to the ear for everyone. This means that we, including visually impaired users, will be able to access many learning resources through a VMLS in the future.

FRAMEWORK OF VMLS
The principle of separating system resources and control is adopted, which is apt to flexibly control resources and then easily extends the scale of the Mobile Learning System.

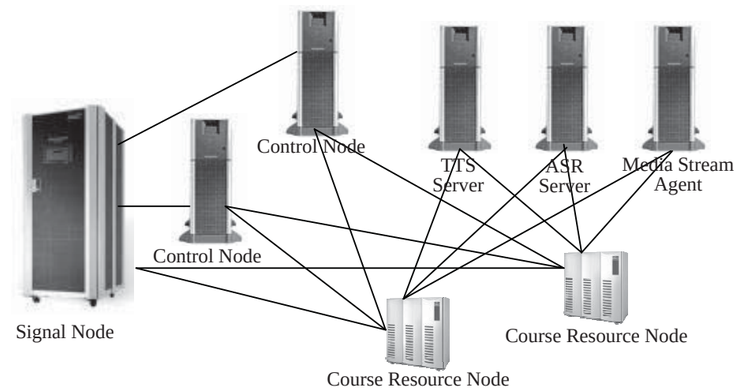

Figure 2. The hardware structure of VMLS

The hardware structure of VMLS can be divided into the following 6 parts: that is, Signal Node, Control Node, Course Resource Node, TTS Server, ASR Server, and Media Stream Agent. Signal Node is chiefly responsible for signal transferring and controlling, connects with Course Resource Node, and communicates with Control Node through LAN. Signal Node connects SS7 Signaling Network and PSTN/PLMN outwards. When voice call is connected, Control Node is notified to startup VoiceXML interpreter instances. Control Node chiefly controls calling, resource managing, VoiceXML interpreter, and course document acquisition. Resource control function is realized through Course Resource Node, TTS Server, ASR Server, and Media Stream Agent respectively.

The software structure of VMLS can be divided into 14 modules. Among them, Signal Stack is used for single transform, XML Parser for parsing the VoiceXML course document provided for VoiceXML Interpreter, the EMCAScript, which is in VoiceXML course document, is realized by EMCAScript Engine, and Log Server provides uniform log output for other modules.

VoiceXML Interpreter is the core of VMLS, many instances of which can exist, each one corresponding to a call.

When VMLS is connected through telephone by a user, Signal Stack immediately notifies Call Control Module. After a connection process, Call Control Module creates a VoiceXML Interpreter instance. The instance will retrieve a VoiceXML Course Document from Course Provider Server or Course Administration Platform by Document Retriever Module, parse it by XML Parser, and then begin to execute. If EMCAScript exists in that Course Document, the VoiceXML Interpreter instance will process it by EMCAScript engine. If Course Document needs to conduct voice interaction with a user, the Interpreter will obtain idle resources by accessing Resource Manager Module, and further operate TTS, ASR and the like through Resource Control Module. After a voice or keypad input, Resource Control Module returns information to VoiceXML Interpreter instance. According to user input, Interpreter decides the next action. For example, the Interpreter accesses the next Course Document through Document Retriever Module, releases the call through Call Control Module, and so on.

When a user releases a call actively, Call Control Module obtains the message from Signal Stack and notifies VoiceXML Interpreter instance through the Event mechanism of VoiceXML.

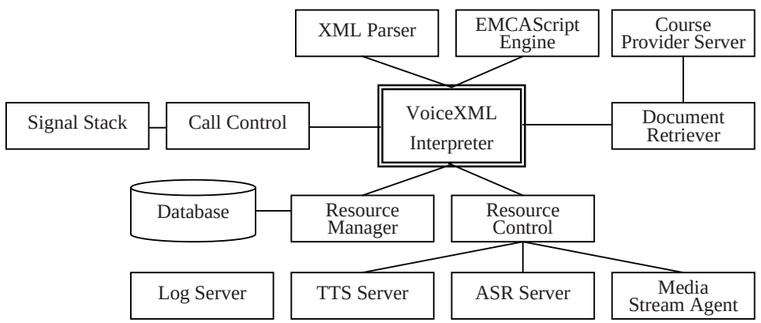

Figure 3. The software structure of VMLS

CACHING STRATEGY OF VMLS

VMLS needs to obtain VoiceXML Course Document and Course Resource through the network, so that it inevitably causes network time delay. However, telephone users will be completely uninterested in it due to the overlong waiting time, which is the key problem that must be solved by VMLS.

To solve this question, before a user accesses VoiceXML Course Document and Course Resource through network, the system should prefetch the resource and store it in a system high-speed cache. Generally, VoiceXML Course Document is much smaller and Course Resource is much larger, so that the object prefetched should not be Course Document, but the Course Resource referenced in VoiceXML Course Document. Therefore, according to historical data accessed by a user to compute the transfer probability among resources, a multi-user sharing and adaptive Markov link is built. The system computes the resource accessed by all online users in the next step and its probability uniformly, superimposes the user need to identical resource, and computes correctly its access probability for better forecasting accuracy. At the same time, because of the limited high-speed cache, a precise resource utility function and an efficient caching replacement algorithm are provided respectively to improve the performance of the cache system and minimize network time delay of furthest response.

Resource Prefetching Algorithm of VMLS

The Mobile Learning System is used by so many people that there must be hot data, which can be counted easily (Chinen et al., 1997; Duchamp, 1999). In that case, a forecasting algorithm based on the hot would have a nice effect and the prefetched resource would also have a high use ratio, which could reduce user waiting time and network traffic and save network resources. However, a hot-based forecasting algorithm couldn't respond to users' continued requests primarily, so other algorithms are adopted to satisfy prefetching demand for the continued requests of users (Davison, 2002; Deshpande et al., 2004; Tauscher, 1997).

One or more dialogs always exist in one VoiceXML page such as form, menu, etc. Each dialog references one or more voice resources. Dialog is the least unit to jump among dialogs and the main body to interact with user. According to the study experience of Web pages, the jumping of a user among dialogs also has the Markov attribute. Therefore, a Markov link can be constructed by making a dialog the least prefetching unit of Voice Resource.

To facilitate description, several definitions are given as follows.

Definition 1. Dialog is the least unit of VoiceXML jumping, labeled as d. $d = \{v_0, v_1, \ldots, v_k, \ldots\}$. v represents Voice Resource, $k = 0, 1, 2, \cdots, K$ presents the number of Voice Resources contained in a dialog.

Definition 2. State Set is the set of all dialogs accessed by users, labeled as $D = \{d_1, d_2, \cdots, d_n, \cdots\}$, wherein, $n = 1, 2, \cdots, N$ represents the number of dialogs in that State Set.

Definition 3. State Transferring Probability presents the probability transferring from a dialog d_i to another dialog d_j, labeled as $p_{i,j} = P\{d_j \mid d_i\} = C_{i,j} / C_i$, wherein C_i is the counter of dialog d_i, $C_{i,j}$ is the transferring counter from d_i to d_j. State Transferring Probability can be used to construct one step $N \times N$ transferring probability matrix, labeled as $P(1)$.

According to the above description, it is easy to construct that Markov link by using historical data information. Because user shouldn't jump randomly, VoiceXML dialog must be accessed by a predetermined order. Therefore the following expression exists.

$$\sum_{j=1}^{N} p_{i,j} = \sum_{j=1}^{N} P\{d_j \mid d_i\} = \frac{\sum_{j=1}^{N} C_{i,j}}{C_i} \le 1$$

Wherein, N is the number of dialogs in the state set.

To minimize state space of the Markov model and to make it adapt to changes of user interest, VoiceXML page etc., one step transferring probability matrix $P(1)$ should be checked periodically and the value in the matrix less than a certain threshold T is set to 0.

Generally, if a user accesses dialog d_i, the access probability of dialog d_j is $p_{i,j}$. To a random $j = \{0, 1, 2, \ldots, N\}$, if $p_{i,j}$ is greater than a certain threshold T, the dialog is deemed to need to prefetch.

But, if there are k users accessing the identical dialog d_i simultaneously, the access probability of d_j is no more $p_{i,j}$, but the probability of d_j accessed by one or more of k users. That is as follows.

$$1 - (1 - p_{i,j})^k$$

In a web site, the forecasting system located on an agent server can't find out the online state of a user and whether a user has finished browsing, so it can't find out the number of users currently accessing an identical web page. VMLS can acquire whether a user is online, so in the practical course of the prefetching algorithm, the prefetching probability of all online users can be computed uniformly.

At the moment, if there are m online users in the system, every user must access a certain dialog. k_i is the number of users accessing dialog d_i. The original distribution is as follows.

$$p(0) = \{k_1, k_2, \ldots, k_n, \ldots\}$$

Wherein, $n = 1, 2, \ldots, N$. Thus, at the moment, $p(1)$ can be acquired by one step of transferring probability matrix. The concrete is as follows.

$$p(1) = \{p_1^1, p_2^1, \ldots, p_n^1, \ldots\} = p(0) \circ P(1)$$

Wherein, operator $\circ$ is defined as follows.

$$p_i^1 = 1 - \prod_{j=1}^{N} (1 - p_{j,i})^{k_j}$$

Wherein, $i = 1, 2, \ldots, N$ represents the number of dialogs.

After $p(1)$ has been acquired, the dialog d whose access probability is greater than threshold T is the needed prefetching object. Add it to the Prefetch Dispatch Queue to wait for dispatching.

If the state of users changes, the transferring course from a dialog to another needs to complete the following steps.

- If the new dialog d_j is not in the state set D, add it to D, extend one step of transferring probability matrix $P(l)$ and initialize its transferring probability.
- Update the values of counters $C_{i,j}$ and C_i .
- Update one step of transferring probability matrix $P(1)$.
- Update $p(0)$, recalculate $p(1)$ and update Prefetch Dispatch Queue according to the dialog probabilities of $p(1)$.

VLMS can acquire user states of online and browsing complete. The prefetching request probabilities of all users are calculated uniformly, which can reduce the probability of repeated prefetching, superimpose access probabilities of some resources, further improve accuracy rate of forecasting, and reduce the waiting time of users.

Caching replacement strategy of VMLS

Because the system cache is limited, caching replacement algorithm becomes a key factor affecting cache system performance. Generally speaking, every resource in the cache has a utility function U. The access probability of resources in the future is determined by that utility function. The resource accessed at a low probability is replaced out of the cache. Adding the resource accessed at high probability into the cache can ensure that the cache system gets a higher hit rate, and reduce user time delay (Liao et al., 2006; Su et al., 2000; Yang et al., 2001).

The utility function of resources should be the usufruct speculation of resources used in the future. The future using usufruct practically contains two meanings. One is the probability at which resource is accessed in the future, which can be labeled as $P_i(t)$. The other is gains of caching the resource. Once a certain resource is cached, it is not necessary to access the server for that resource next time. Therefore, the gains of caching resources are the cost of acquiring that resource. The cost contains CPU time needed for acquiring that resource, network bandwidth, time delay and so on, which can be labeled as $C_i(t)$. Obviously, according to the gains of cache resource, the utility function should be expressed as follows.

$$U_i(t) = P_i(t) \times C_i(t)$$

Wherein, the cost of acquiring resource $C_i(t)$ can be estimated through the historical data of resources acquired previously. How to determine the probability of resources accessed in the future $P_i(t)$ is the bottleneck problem.

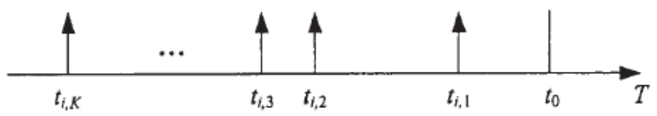

Figure 4. Access sequence of resource

As everyone knows, the access intervals of resources often conform to a certain random distribution, which is labeled as $E_i(x)$. The access sequence of the resource is showed in figure 4. Wherein, t_0 represents the current time. The system records 4 recent access moments in total, which are $t_{i,1}$, $t_{i,2}$, $t_{i,3}$, $\cdots$, $t_{i,K}$ respectively. The average of access time intervals conforms to the following formula.

$$E_i(t) = \frac{1}{K-1}\sum_{j=1}^{K-1}(t_{i,j} - t_{i,j+1})$$

Average of resources access time intervals is smaller; the access probability of resources in the future period of time is bigger. That is $P_i(t)$ has an inverse relation with its average. Therefore, the following formula can be gotten by making $P_i(t)$ equal to the reciprocal of $E_i(x)$.

$$P_i(t) = (K-1)\Big/\sum_{j=1}^{K-1}(t_{i,j} - t_{i,j+1})$$

However, once access time interval distribution of the resource changes and its average becomes larger, which means that the former K access moments are no longer quite accurate, the computed access probability value still hasn't changed. If replacement selection is done according to the result of the above formula, the system will store resources which shouldn't be stored and caching pollution will result. Therefore, the above formula should be modified. Given the general cases, if the average of access time interval distribution becomes larger, $\Delta t_{i,0} = t_0 - t_{i,1}$ would be affected. Thus, the modified function $Fix_i(t_0 - t_{i,1})$ is introduced. The aim is to modify the result of the above formula according to the value of $\Delta t_{i,0}$. The formula becomes the following one.

$$P_i(t) = Fix_i(t_0 - t_{i,1}) \times (K-1)\Big/\sum_{j=1}^{K-1}(t_{i,j} - t_{i,j+1})$$

So utility function can be expressed as follows.

$$U_i(t) = C_i(t) \times Fix_i(t_0 - t_{i,1}) \times (K-1)\Big/\sum_{j=1}^{K-1}(t_{i,j} - t_{i,j+1})$$

If $\Delta t_{i,0}$ is simply deemed to sample value of next access time interval, the modified function can be expressed as follows.

$$Fix_i(t_0 - t_{i,1}) = \frac{K}{K-1} \times \frac{\sum_{j=1}^{K-1}(t_{i,j} - t_{i,j+1})}{\sum_{j=1}^{K}(t_{i,j-1} - t_{i,j})}$$

Wherein, $t_{i,0} = t_0$ is assigned and the utility function can be expressed as follows.

$$U_i(t) = C_i(t) \times K\Big/\sum_{j=1}^{K}(t_{i,j-1} - t_{i,j})$$

Obviously, the new utility function saves the historical access data of all resources and adds in cost function of resource acquisition $C_i(t)$. The effect becomes better.

The concrete caching replacement strategy is as follows.

- Calculate the utility function of each resource.
- Queue the gains, utility function, of all the resources stored in resource set $S1$ of the cache.
- If the set of new resources needed to prefetch is $S2$, the sum $U2$ of gains of all the resources in the resource set $S2$ is calculated.
- According to the ascending sequence of resource gains, select one or more resources from $S1$, make the sum of its size and the size of current spare cache larger than that of new resources needed to prefetch, and then calculate the sum $U1$ of its gains. If $U1$ is smaller than $U2$, delete it from cache and add the new resource needed to prefetch into cache. Otherwise, the algorithm is over and the new resource can't be cached.

CONCLUSION

In the paper, a VMLS is studied, its hardware and software system structure design is achieved, and aiming to address network time delay, an adaptive Markov prefetching algorithm shared by multi-users and a new efficient caching replacement strategy are provided. Taking advantage of the characteristic that VMLS can sense whether the user is online, the resource needed for the next step and its probability are calculated uniformly, which improves the forecasting accuracy rate. At the same time, a more accurate utility function of resources is constructed and a new efficient caching replacement algorithm is provided, which improve the overall performance of the cache system. The research findings could not only be used in VMLS, but also could be used in other voice-based application system studies. For example, it has important reference value in research fields of Voice Browser, IVR, Voice Portals, Voice-based Electronic Commerce, and so on.

The constructing of VMLS will be studied further in many aspects, such as an Authoring Tool of VoiceXML Course Document, Educational Administration Tool of Mobile Learning System and so on, which will be the next burning issues to study.

ACKNOWLEDGMENTS

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Enhancing Ubiquitous Learning Using Video-based Life-Log

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ABSTRACT

This paper proposes a personal learning assistant called LORAMS (Link of RFID and Movies System), which supports learners with a system to share and reuse life-log data by linking movies and environmental objects. These movies are not only kind of classes' experiments but also daily experience movies. LORAMS can infer some contexts from objects around the learner and search for shared movies that match with the contexts. We improved two functions of the previous version of LORAMS. One function is to compare the learner's video with the video of a similar situation. By this function, the learner can notice her/his good and bad actions. The other function is to allow the learner to add video annotations. By this function, learners can obtain information that is difficult for them to understand from only the video. We think that these videos are very useful to learn various kinds of subjects. We did an experiment (cooking), and we investigated the effect of using the video comparison. Then, we got the result that the learner's performance of doing a task using this comparison system is better than before.

Keywords

Ubiquitous Learning, Lifelog, RFID tag, multimedia, rich media

INTRODUCTION

Ubiquitous computing (Abowd & Mynatt, 2000) will help organize and mediate social interactions whenever and wherever these situations might occur (Lyytinen & Yoo, 2002). Its evolution has recently been accelerated by improved wireless telecommunications capabilities, open networks, continued increases in computing power, improved battery technology, and the emergence of flexible software architectures (Sakamura & Koshizuka, 2005). With those technologies, CSUL (Computer Supported Ubiquitous Learning) is realized, where individual and collaborative learning in our daily life can be seamlessly included.

One of the most important ubiquitous computing technologies is RFID (radio frequency identification) tag, which is a rewritable IC memory with non-contact communication facility (Brown, Collins & Duguid, 1989). This cheap, tiny RFID tag will make it possible to tag almost everything, replace the barcode, helps computers to be aware of their surrounding objects by themselves, and detect the user's context (Borriello, 2005). The features of RFID tag are as follows:

(1) Non line-of-sight reading: RFID is not necessary for line-of-sight reading like a bar code.

(2) Multiple tag reading: Unlike a bar code reader, RFID unit can read multiple tags at the same time.

(3) Data rewritable: RFID has a memory chip that can be rewritten using an RFID unit; on the other hand, the data of a bar code is not changeable.

(4) High durability: Tags are very sturdy from vibrations, contamination (dust and dirt), and abrasion (wear). Hence, tags can be permanently used.

(5) Ease of maintenance: There are two types of RFID tags. One is passive, which does not use any battery. The power comes from the reader unit. Therefore, passive tags can be used permanently. The other one is active, which contains batteries and has a longer range than passive ones.

We assume that almost all products will be attached with RFID tags in the near future, where we will be able to learn at anytime at anyplace from every object by scanning its RFID tag.

The fundamental issues in CSUL are

(1) How to capture and share learning experiences that happen at anytime and anyplace.

(2) How to retrieve and reuse them for learning.

As for the first issue, video recording with handheld devices will allow us to capture learning experiences. Also consumer generated media (CGM) services such as YouTube [http://www.youtube.com/] help to share those videos. The second issue will be solved by linking the objects in a video with RFID tags, so that the system can recommend videos in

similar situations to the situation where the learner has a problem. In addition, the learning will be improved by comparing the video of the learner's experience with the video of a similar situation.

This paper proposes LORAMS (Linking of RFID and Movie System) for CSUL. There are two kinds of users in this system. One is a provider who records his/her experience into videos. The other is a user who has problems and retrieves the videos. In this system, a user uses his/her own PDA equipped with RFID tag reader and digital camera, and links real objects with the corresponding objects in a movie and shares it among other learners. Scanning RFID tags around the learner enables us to bridge the real objects and their information into the virtual world. LORAMS detects objects around the user using RFID tags and provides the user with the right information in that context.

As for related works, there are two kinds of educational applications using RFID tags. The first type is applications that can identify the objects on a table and support face-to-face collaboration. For example, EDC (Envisionment and Discovery Collaboratory) (Arias et. al, 1999) and Caretta (Sugimoto, Hosoi & Hashizume, 2004) consist of a sensing board and objects with RFID tags such as house, school, etc. Detecting objects on the table enables the systems to show the simulation such as urban planning. Also TANGO (Tag Added learNinG Objects) system supports learning vocabularies (Ogata & Yano, 2003; 2004a; 2004b; Ogata, Akamatsu & Yano, 2004). The idea of this system is to stick RFID tags on real objects instead of sticky labels, annotate them (e.g. questions and answers), and share them among others. The tags bridge authentic objects and their information into the virtual world.

The second type is the applications that can detect the learner's location using RFID tags that allow the system to track the learner's position and send the right messages to the learner. eXspot (Hsi & Fait, 2005) is an example of this type of application, which is designed for museum educators; it can capture the user's experiences at a museum for later reflection. This system consists of a small RFID reader for mounting on museum exhibits and RFID tag for each visitor. While using RFID, a visitor can bookmark the exhibit s/he is visiting, and then the system records the visitor's conceptual pathway. After visiting the museum, the visitor can review additional science articles, explore online exhibits, and download hands on kits at home via a personalized web page.

In this way, RFID is very useful for identifying objects precisely. LORAMS system utilizes the full advantage of RFID to capture, share and reuse personal experiences for ubiquitous learning.

LORAMS

Features

The characteristics of LORAMS are as follows:

(1) Learner's experience is recorded into a video and linked to RFID tags of physical objects. The video can be shared with other learners.

(2) When the learner uploads the video, it will be automatically encoded with the server.

(3) Learners can find suitable videos by scanning RFID tags and/or entering keywords of physical objects around them.

(4) The learner can compare the video of a similar situation with the learner's video.

(5) All learners can freely add annotation to videos.

There are three phases for LORAMS as follows:

(1) Video recording phase.

(2) Video search phase.

(3) Video replay phase.

   a. Normal Replay (NR)

   b. Comparing Multi Replay(CMR)

Video recording process needs a PDA, RFID tag reader, video camera, and wireless access to the Internet. First, the user has to start recording video at the beginning of the task. Before using the objects, the user scans RFID tags and the system automatically sends the object data to the server. This data is recorded in the database with timestamp. The user scans RFID tags again when the user finishes using the object. The user repeats the previous procedure until finishing the task. After completing the task, the user uploads the video file to the server. Then, the server automatically starts encoding the video file. After encoding, the user inputs some personal information.

On the other hand, video search and replay processes need PDA, RFID tag reader, and Web browser. The learner scans RFID tags around him and/or enters some keywords, and then the system sends them to the server and shows the list of the videos that match the objects and/or the keywords.

User Interface

In recording phase, the learner sets up the information for the RFID reader such as port number and code type. At the beginning of the task, the learner inputs the user name and pushes the "Send" button (1). Then, the learner pushes the "Start-Read" button at the same time that recording starts (2). When you read RFID tags, the data will be automatically stored in the server. As shown in the right side of figure 1, the RFIDs are linked to the video.

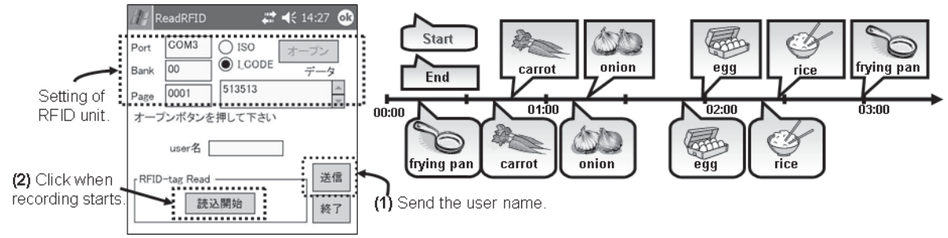

Figure 1. The interface of the recording phase (left) and video timeline (right).

In the search phase, as shown in figure 2, the user scans RFIDs and/or enters keywords in (B), then the images of the scanned objects will be automatically displayed at the top of the page as shown in (A). Also, the system will display the result in (C). It is easy to recognize the content of the video from its thumbnail. The video can be replayed using Flash 8 player. The list of objects used in the video is displayed in (D). By dragging & dropping the icon shown in (E) on the screen, all learners can freely add annotations to the video. LORAMS automatically retrieves similar situations to the learner's video in (F). In figure 3, two videos are replayed to make a comparison. In (G), a bar shows when and what objects the learner is using.

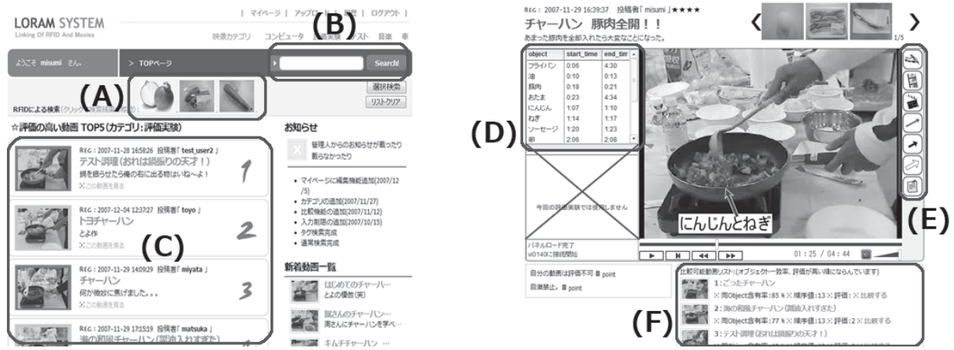

Figure 2. The interface of index page (left) and normal replay (right).

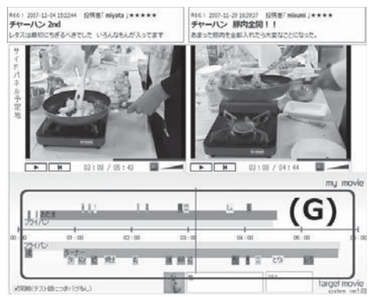

Figure 3. The interface of CMR.

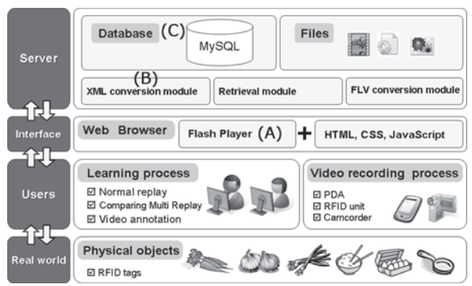

Figure 4. System configuration

System configuration

We have developed LORAMS, which works on a Fujitsu Pocket Loox v70 with Windows Mobile 2003 2nd Edition, RFID tag reader/writer (OMRON V720S-HMF01), and WiFi (IEEE 802.11b) access. RFID tag reader/writer is attached on a CF (Compact Flash) card slot of PDA. The tag unit can read and write data into and from RFID tags within 5 cm

distance, and it works with a wireless LAN at the same time. The LORAMS program has been implemented using Embedded Visual C++ 4.0, PHP 5.2.0, Perl 5.8.8 and Flash 8. Figure 4 shows the system configuration.

The video is played according to following mechanism:

(1) The player (A) sends a unique ID of the video to the server.
(2) XML conversion module (B) receives the video ID and extracts video information from the database (C) and converts it into XML formats.
(3) The XML file is passed to the player, and then the file is analyzed using ActionScript.
(4) When the player (A) receives the video information, the video file will be downloaded. Because the file is downloaded by the progressive download method, it is possible to replay while downloading it.

Recommend method of similar situation with the learner's video

The following algorithms are used in LORAMS to look for a video which contains a similar situation to the learner's video. There are two criteria. One is to consider the rate of the same objects, while the other is to calculate the similarity of the order of the objects, as follows:

(1) The videos are listed according to the rates of the same objects in the different videos.

(2) If the rates of (1) are the same, then the videos are listed according to the similarity of the order of the objects.

We use "Kendall's rank correlation coefficient" in the second algorithm. To apply this algorithm, we selected common objects of two videos. The common objects are re-numbered according to the order in which the objects were used. Then, the algorithm is applied to the set as shown in Table 1. And, the learner can visually confirm the similarity in the graph as shown in Figure 4.

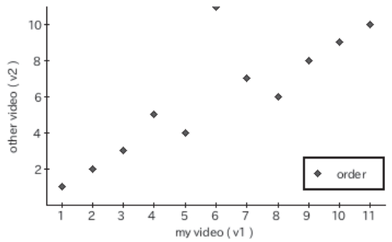

Figure 5. Graph of similarity

Object ID	Object name	Order (v1 , v2)
E1000005	flying-pan	(1 , 1)
EC000002	cooking oil	(2 , 2)
E0000012	onion	(3 , 3)
E0000013	carrot	(4 , 5)
E1000002	ladle	(5 , 4)
…	…	…
EC000005	salt	(9 , 8)
EC000006	pepper	(10 , 9)
EC000010	soy sauce	(11 , 10)

Table 1. Object table

EXPERIMENTATION

We investigated the effect of using the video comparison. The task was cooking fried rice. The cooking method, utensils and ingredients vary from person to person. Therefore we think that cooking is a suitable task for the evaluation process.

Experimentation design

Twenty-one students from the department of computer science in the University of Tokushima were involved in the experiment. These 21 people were divided into groups A (11 people) who were experts in cooking and groups B (10 people) who were beginners.

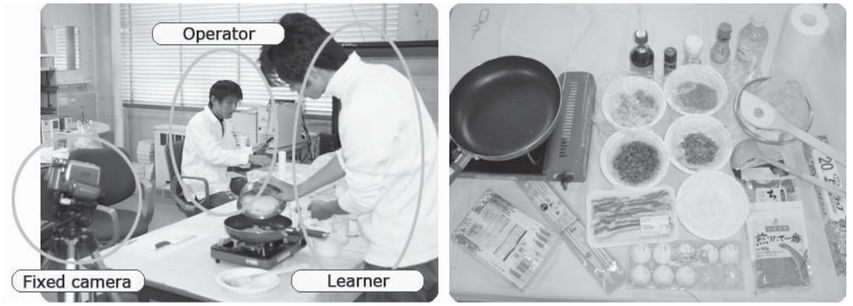

Figure 6. Appearance of the experiment (left) and a part of the ingredients and tools (right)

We assume that a learner is cooking at home and shoots a video by himself. Therefore, the camera is fixed and captures at hand activity. It is difficult for learners to cook fried rice while scanning RFID tags. So, in this evaluation, an operator was scanning RFID tags for the learner. In the future, if the RFID reader becomes smaller, it will be easy for the learner to read the RFID tags by himself. The left side of figure 5 shows an actual appearance.

The learner can freely cook and select various utensils and ingredients. We prepared 8 kinds of seasonings, 17 kinds of ingredients and 5 kinds of utensil. The right side of figure 5 shows a part of the ingredients.

Result

After the experiment, all students filled in a questionnaire. They gave a rate from 1 (the worst) to 5 (the best) as an answer for each question. The result is shown in table 3. The average (Avg.) and standard deviation (SD) for the learners' answers are illustrated.

The result in Q1 comparatively obtained the great result with 4.3. While cooking, this result shows that an individual experience video is useful. Many learners believed that they obtained new knowledge by using the system according to the result of Q2. We think that this result showed that many experts in cooking provide high-quality videos of cooking and the non-experts obtained new knowledge from these videos.

A very good result of 4.6 was obtained in Q3. This result shows that we could notice difference with others and your own mistakes by seeing the videos that LORAMS offered. However, in Q4, it is a somewhat low value in comparison with the others but it is not so bad. This result shows that the offered videos from LORAMS are very useful, but the interface is not easy to use. Therefore, the improvement of the interface becomes one of the future works.

No.	Questionnaire	Avg	SD
Q1	Does the LORAMS serve as a reference in cooking?	4.3	0.59
Q2	Did you get the new knowledge by using LORAMS?	4.3	0.47
Q3	Are you able to recognize your mistake and the difference with others by watching the video that the system offered?	4.6	0.62
Q4	Is it easy to compare multi replay?	4.1	0.86
Q5	Which learning method is easy to learn, comparison multi replay or normal replay?	4.1	0.93
Q6	Can you notice your mistake by using LORAMS?	4.6	0.51
Q7	Do you want to make some studies use of LORAMS in the future?	4.4	0.71
Q8	Do you want to share your learning experience with others?	4.0	1.00
Q9	How about the taste of the fried rice that you made?	6.2	1.88

Table 2. Results of the questionnaire

According to Q7 and Q8, almost everyone wants to use LORAMS as a learning assistance. By contrast, they are not enthusiastic about sharing videos. This result can be understood from the followings reasons.

- "I am ashamed to share clumsy videos."
- "I want to share videos after improving my cooking."

Group	Replay	NR	Avg.	CMR	Avg.
A	205	157	11.3	48	4.4
B	367	316	31.6	51	5.1
Total	572	473	22.5	99	4.7

Table 3. Number of replay

(A) Timing in which egg in put
(B) Timing in which vegetable is put
(C) Stir-fried time
(D) How to handle frying-pan
(E) Smoothness of work

Table 4. Reflection points

According to Table 4, the total replays were 572 in two days. It shows that the learners have a deep interest in the experience videos. Table 5 is a part of the reflection points that the learner obtained by the comparison. It seems that there are three types of reflection point. The first is timing such as (A) and (B). The reflection point of this type can be gotten from the timeline. The second is time such as (C). This can be gotten from the timeline, too. The last is actions such as (D) and (E). The reflection point of this type is obtained by comparing the video. Timing and actions are important in the cooking. This result shows that the learners are able to learn the important point by using LORAMS.

Figure 6 shows an example of the comparison. This is a timeline of an expert learner in cooking (upper) and the learner who has scorched the fried rice (bottom). We can notice two points that should be paid attention from the timeline. First, this learner takes a longer time to finish up the cooking compared with the period (A) of the expert learner. Second, the learner spent a longer time than the expert without putting anything in the frying pan in (B). The expert is regularly putting in ingredients. The temperature of the frying pan falls when adding foodstuffs. Therefore, the time that this learner spent without putting the foodstuffs in frying pan caused it to scorch. Figure 7 shows the timeline of the learner before using LORAMS (upper) and after using it (bottom). The learner becomes a good cook after using LORAMS.

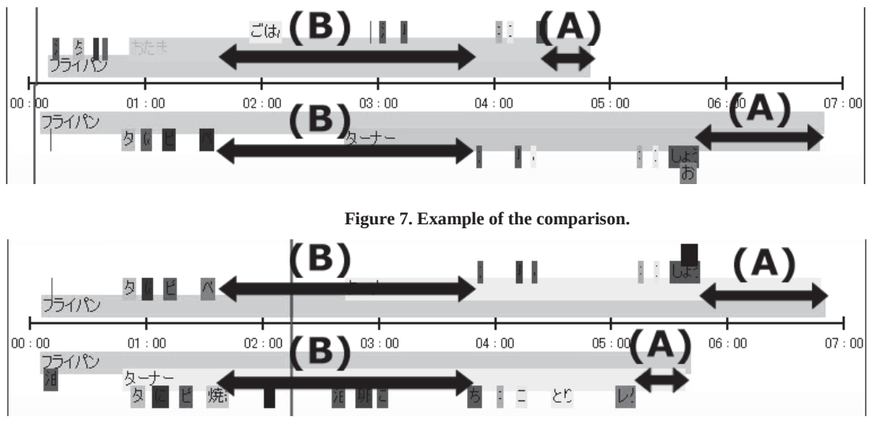

Figure 7. Example of the comparison.

Figure 8. Before using LORAMS (upper), after using LORAMS (bottom).

RELATED WORKS

Adding annotations to video

It is necessary to make annotations and add keywords to the video in order to improve the process of searching for videos. Therefore, there is various research of putting a detailed annotation to the animations (Davis, 1993; Nagao, Shirai & Squire, 2001; Smith & Lugeon, 2000). However, a lot of human costs and time are necessary for these methods of producing videos. Where the viewer puts the annotation of the video contents, therefore the producer effort is decreased. Also, accurate intelligence is added to content by artificially giving the annotation (Yamamoto & Nagao, 2005).

Life log

"Life log" preserves the video content, voice, position (GPS) of that time, and information from various sensors that are combined in the database. It puts up the key to search the video of a user's own life log, and searches these videos. Moreover in Ubiquitous Memories (Kawamura et. al, 2005), the RFID tag is used as a trigger that makes people recall their memories from their Life log.

CONCLUSIONS AND FUTURE WORK

This paper proposes a ubiquitous learning environment called LORAMS (Link of RFID and Movies System), which supports the learners with a system to share and reuse learning experience by linking movies and environmental objects. The evaluation showed the following results.

(1) It is useful to compare the experience video with others.
(2) Learners are keenly interested in learning experience videos.
(3) The personal cooking videos are helpful for learners.
(4) Of the system interface is very important.

In future work we will enhance the user interface, improve the recommendation method, and allow the learner to add more annotations on the video. In addition, we will develop a desktop gadget that supports awareness in cooperation with LORAMS.

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Supporting Communicative English Class Using Mobile Devices

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ABSTRACT
This paper describes a student interactive speaking-listening support system using mobile devices. This system makes use of PDAs (Personal Digital Assistants) as a recording tool. Peer-to-peer interviews and interviews with international students were conducted in a communicative English class of 20 university sophomores. The students uploaded the recorded files of interviews to the LMS (Learning Management System) and shared the files by listening and made summary reports which were also uploaded to the LMS. Advantages and disadvantages of the system are discussed. In conclusion, though some weaknesses are pointed out, its usability, mobility, novelty, and especially its recordability contribute to the making of a successful communicative English class, and a combination of PDA and LMS helps make efficient use of class time and provides effective support for evaluation.

Author Keywords
PDA (Personal Digital Assistant), Mobile Learning, LMS (Language Management System)

INTRODUCTION

In Japan, we generally start to learn English at junior high school aged 12 – 13. There are four skills of language learning, i.e. reading, listening, speaking and writing. The aim of language education should be to develop all these four skills in a well-balanced manner. But Japanese students are often said to be good at reading while they are poor at speaking and listening (Takanashi, 2004). It is mainly because the emphasis is put on rote memorization and grammar-translation at junior and senior high schools in order to prepare for very competitive university entrance examinations (Ribble, 1997). As for listening, however, it has been introduced since 2006 to assess listening proficiency in the national center test for university (preliminary university entrance examinations administered by the government), so some improvement for listening proficiency is hopefully expected. As for speaking, it is unlikely to happen for universities or any institutes to employ speaking tests at the entrance exams. Therefore speaking, or communicative competence should be much emphasized after they enter the universities to compensate the unbalanced proficiency in four skills. But in reality, it is far to say that there are a sufficient number of communicative English classes at universities. For instance, in the University of Tokushima, a mid-size national university of 6,096, undergraduate students (as of May 1, 2008), there were 33 Communicative English classes of about 20 students (approximately 660 students enrolled) and 69 non-communicative English classes of 40-50 students (approximately 3,100 students enrolled) in spring semester 2008.

In addition, it has always been a serious problem for instructors of communicative English class to evaluate the class. Communicative ability is best measured situationally (Upshur, 1971). Traditionally the common method of evaluating communicative competence is to communicate with the students, face to face, one by one or group by group and judge them during the class. Therefore evaluation is a heavy load for instructors. Moreover it uses up class time. Since there usually is only one instructor per class, he/she has to give the students some self-study type of tasks during evaluation. If recording is possible in the classrooms such as CALL (computer-assisted language learning) rooms or LL (language laboratory) rooms, they can evaluate by listening to the tapes or recorded files after class. But the number of such well-equipped rooms is very limited. Furthermore, there is no established method of evaluating speech performances (Yoshida et al., 2006). Such difficulties of evaluation are one of the reasons why there are not many communicative English classes at any level of English education in Japan.

But if mobile devices are used as a voice recorder, digital recording of students' voices would be possible, so that the instructors will be able to evaluate after class. So it is hoped the use of mobile devices will help make more effective use of class time, will facilitate communicative English learning process, and hopefully and ultimately will contribute to the improvement of communicative competence of Japanese ESL (English as a second language) learners.

STUDENT-INTERACTIVE SPEAKING-LISTENING SUPPORT SYSTEM USING MOBILE DEVICES

Mobile Language Learning

Research on the practical uses of mobile technology for language learning have been very active in recent years (Chinnery, 2006; Lan et al., 2007; Ogata and Yano, 2008; Petersen and Markiewiez, 2008; Saran et al., 2008; Yin et al., 2005; Paredes et al., 2005). As mentioned above, there are four skills of language learning. Mobile technology has been applied to training tools for listening, reading, and writing skills, which include software and systems installed in PDA, iPod, Nintendo DS, and Sony PSP. However, little attention has been paid to the use of mobile devices as a tool to help improve speaking skill. Research on a communication support system using companion agent has been reported, but there exist some problems to be solved such as speech recognition and understanding. So it is not in practical use yet (Huang et al., 2008).

Ubiquitous Learning

An original learning management system (LMS) called u-Learning System has been developed and provided for more than five years at the University of Tokushima, which enables instructors to manage their courses and exchange information with students for a course (Ogata et al, 2008). This system has been developed under the concept of ubiquitous computing or ubiquitous learning, which denotes helping organize and mediate social interactions wherever and whenever these situations might occur (Ogata and Yano, 2008). PDA room (Figure 1), which was created in 2005, is one of the realizations of this concept. The equipped model was Fujitsu Pocket LOOX (FLXV7).

If students are provided mobile devices as a recording tool, they will be able to record their interviews and upload to the u-Learning system. By doing so, they will be able to share the recorded files and listen to other peer interviews. Instructors will be able to check their students' performances outside class. Consequently, they will be able to make efficient use of class time. Thus in this study, we suggest a student-interactive speaking-listening support system using mobile devices combined with LMS in communicative English class.

Figure 1. PDA room

Motivation

It is reported that motivation is a very important variable in accomplishing the ultimate goal of language learning (Oxford and Shearin, 1996). It helps improve English to have a specific purpose when we study it. One of the authors' students, who was expected to go to America in a few months, showed dramatic improvement in her English. In reality, it is impossible for the whole class to go to English-speaking countries. But quite a few international students are studying on campus. There are 259 international students from 28 countries studying at the University of Tokushima as of May 2008 (223 from Asia, 21 from Africa, 6 from Europe, 4 from Middle East, 3 from Central & South America, and 2 from North America). So there must be some way to design the class to make it look like being in a place where English is spoken. Taking the above mentioned elements into account, we have designed a class where students conduct interviews with peers and at the very last stage, with international students.

System Design

Collaborative and interactive learning approaches for foreign language has received much attention these past years (Chen, 2003). Unlike typical traditional ESL classes, which are mostly teacher-centered, our suggested system is characterized by student-interactive-learning. The use of mobile devices makes it possible for the focus in the classroom to be shifted from the teacher to the learner. In this system, interactive-learning consists of two sections: the peer-to-peer interaction and the peer to international student interaction (cf. Figure 2).

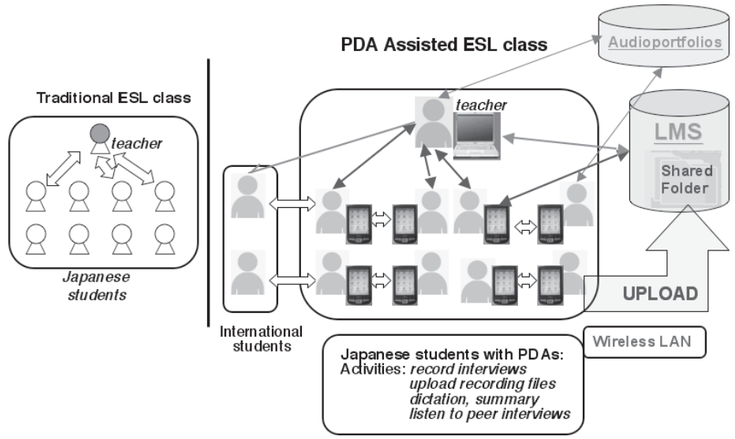

Figure 2. Comparison of the Two Class Types

The system's learning sequence was as follows:

(1) Making Questionnaires => (2) Practice by Listening to the Instructor's Model Reading => (3) Peer-to-Peer Interview => (4) Interview with International Students => (5) Dictation and Summary Report.

(1) and (2) are a preparation process. Questions made by students are uploaded to the LMS. Model readings made by the instructor can be heard through Audio Portfolios (http://www.audioportfolios.com/). (3) and (4) are the highlight of the project. Interview sessions can be conducted either in the classroom or outside the classroom. The recorded data are uploaded to the LMS and shared by students through shared folders in the LMS. (5) is a finishing process. The summary reports are uploaded to the LMS.

USER STUDY

The target class consisted of 20 sophomore students (11 males, 9 females) who majored in pharmaceutical sciences. Out of total of 15 classes on a weekly bases during spring semester 2007 (April to July), four classes in June were used for the interview project.

Learning Sequence

(1) Making Questionnaires

The students were assigned to make at least 20 questions in English which might be useful for an interview and submitted it to u-Learning system. The instructor made corrections if there were any errors. Table 1 shows one sample submitted by one of the students. The assignment was given to the students about a month ahead of the first interview day.

1	Where are you from?	11	What day is your birthday?
2	Do you have any brothers or sisters?	12	What do you do for recreation?
3	Do you have any pets?	13	Where do you do your shopping?
4	What do you do in your free time?	14	How long have you been in Japan?
5	What kind of music do you like?	15	What color do you like?
6	What sports do you like?	16	Have you ever been to any place but Tokushima in Japan?
7	What are you going to do during the summer vacation?	17	What is your country famous for?
8	What food do you like?	18	Did you have any troubles since you came to Japan?
9	Do you like Japanese food?	19	What do you want to be in the future?
10	What is your blood type?	20	Why did you decide to come to the University of Tokushima? ,

Table 1. Questionnaires made by one of the students

(2) Practice by Listening to the Instructor's Model Reading

The instructor's model reading of their questions was recorded in the website called Audio Portfolios (http://www.audioportfolios.com/). The students were given an oral practice assignment of the questions made by themselves by listening and repeating after the instructor's model reading.

Audio Portfolios makes use of two-way streaming made available through the Flash Communication Server MX where the program for logging in students and tracking their files runs on the server. They can make recordings and listen to them directly through this system, so there is no need to upload and download recorded files. In any place where Internet access is possible, we can listen to them whenever and wherever we want and practice as many times as we want.

(3) Peer-to-Peer Interview

After preparation process was done, each student conducted an interview with another student like a pair work. The peer-to-peer interview was conducted three times. The partners were chosen by lottery. They made recordings of their interviews. They were told that they could feel free to go anywhere during the interview. But it turned out that they preferred to stay in the classroom. After the interview, they uploaded their recorded files (.wav file) to the shared folder in the u-Learning system and listened to other interviews in the shared folder.

Since no one had ever used PDAs before, at the beginning of the first PDA class, the students received a full explanation about how to use them by an expert instructor. PDA class was held four times in total (three peer-to-peer interviews and an interview with an international student). Besides one regular English instructor, four technical staff (one professor, one engineer, and two assistant students) came to the class the whole time to help the students as supporters and trouble shooters.

(4) Interview with International Students

Five volunteer international students were recruited beforehand (about a month ahead) through personal connections. One of them was absent on the interview day, so four of them joined the class. They were all graduate students at the University of Tokushima. Their nationalities were Malaysia (f: 25), Egypt (m: 34), Bhutan (m: 22), and Peru (m: 35).

The whole class was divided into four groups (five per each group). Each international student got interviews from five students during 90-minute-class. Since one student was absent on Interview day, a total of 19 students had interviews. The students (interviewers) waited for their turn to come in the classroom (PDA room), while four interviewees were sitting at four different places (two in the PDA room and two in other places in the same building). The longest interview lasted 14 minutes 47 seconds and the shortest one lasted 2 minutes 58 seconds, with an average length of 8 minutes 11 seconds (cf. Figures 3 & 4).

Figure 3. Interview with an International Student A

Figure 4. Interview with an International Student B

(5) Dictation and Summary Report

After the interview, the students uploaded the recorded files to the u-Learning system (LMS). Then they listened to them, wrote them down, and made summary reports and uploaded to the system (cf. Figure 5 & Table 2). Since interview sessions lasted long, summary reports became homework assignments with a due date of two weeks ahead.

Figure 5. Students making summary reports after interview

J: My name is XXX. May I ask your name?
I: My name is YYY. You, call me YYY. I'm from Malaysia. Where are you from?
J: I'm from Yamaguchi, the westest of Honshu.
I: Ah, Yamaguchi, my Japanese language Sensei is from Yamaguchi. He says the will and fugu is famous things in Yamaguchi.
J: *Fugu is famous, but I have not eaten fugu (*fugu : name of a fish)
I: Oh, O.K. I've not eaten fugu because it's too expensive.
J: Fugu is popular in Shimonoseki, the westest of Yamaguchi.
I: I see. So, you're not stayed at west of Yamaguchi. Which part of Yamaguchi?
J: Yamaguchi-shi. City center. Center of Yamaguchi.
I: I've never been to Yamaguchi, so I'm not sure. What do you like about Yamaguchi? At nice places?
J: Yamaguchi has a spa. It is called "Yuda-Onsen"
I: Oh, I see. Sounds nice. I like onsen.
J: My favorite food is Japanese rice. Rice and natto. (*natto : fermented soybeans)
I: So, do you eat natto every day?
J: Yes, every morning I eat natto.
I: So you are very healthy. What is your hobby?
J: My hobby is reading books but recently, I can't read books. How about you?
I: I love hiking, jogging, reading, talking.
J: Where do you hike? Bizan?
I: Around in Tokushima. I've been to Tsurugizan 3 times, and other mountains in Tokushima.
J: What did you think of Japan before coming here?
I: I think Japanese are very friendly people. Before coming here, I didn't have any images, anything about Japan. So, I get to learn all things there is industry. I think Japan is a country who has interesting cultures, handy cleverness because Japanese are very detail, particular.
J: Thank you for much you time.
I: Thank you, XXX.
J: Enjoy your stay in Japan, YYY.
I: Thank you very much.

Table 2. Summary Report by one of the students uploaded to u-Learning system(excerpt)

J: Japanese student I: international student

RESULTS AND DISCUSSION

After the whole procedures were completed, a questionnaire survey with a five point scale was conducted among the students.

The Survey Result

The survey result is shown in Table 3. The highest average score of 4.42 was given when asked whether it was useful to conduct an interview with an international student, 3.53 when asked whether it was fun to use PDAs combined with u-Learning system, 3.32 when asked whether PDA class was useful, 3.21 when asked whether recording of your voice by PDA was useful, while the lowest of 3.16 was given when asked whether listening to the English spoken by the other classmates was useful.

The contents of the questions	average points (full satisfactory : 5)
Was recording of your voice by PDA useful for your improvement of your English?	3.21
Was listening to recorded files by other students useful for your improvement of your English?	3.16
Was an interview with an international student useful for your improvement of your English?	4.42
Totally was PDA class useful for your improvement of your English?	3.32
Was it fun to use PDA combined with u-Learning system?	3.53

Table 3. The Result of the Five-point-scale Style Survey

●Comments from the students about PDA:

- able to use the Internet wherever we are
- easy to make a recording
- handy and convenient
- quick start-up
- like a small computer
- terrific
- running out of battery quickly
- troublesome to input by small pen(stylus)

●Comments from the students about u-Learning system:

- easy to submit assignments
- log-out too soon automatically when not used

The Instructor's View

The use of mobile devices made the interactive-learning style of class very successful. Otherwise, peer-to-peer interviews and peer-to-international student interviews would not have been digitally recorded. These interviews would have been

just then-and-there activity. It was not long ago to see language teachers carrying lots of cassette tapes and struggling with them for evaluation. As a matter of fact, cassette tape recorders are still in use in many language laboratories. It had long been hoped that digital recording would come into realization. Since its realization, we have been able to upload and download recorded data. Thanks to that, evaluation is possible anytime, anyplace outside of class without struggling with loads of tapes. So it is not too much to say that the use of PDA was the realization of a long time dream of the instructors of communicative English class.

The use of PDAs is good because:

1) Digital recording made interactive-learning possible.
2) The instructor does not have to carry piles of things like cassette tapes.
3) Recorded data can be uploaded to the university's LMS through wireless LAN.
4) Its easy handling (easy to record, quick start-up) helps make efficient use of class time.
5) Its mobility makes it possible for the whole class to have interviews in separate places in order not to be bothered by other interviews being held at the same time. Without this mobility, it was difficult to carry out this interview project.
6) Unlike face-to-face speech performances in front of the instructor, which vanish instantly, recorded data are kept permanently unless deleted, and can be heard repeatedly. The notion that they will remain for good helps motivate the students to make performances as good as possible. They did every activity (practice / rehearsals / real interviews) diligently and earnestly throughout the project.
7) As Thornton and Houser (2005) reported about the novelty effect of mobile handheld devices in language class, the students showed much interest in new devices since it was their first time to use PDAs. As soon as they entered the PDA room, they found them and many of them touched them and tried to use them without being asked to do so. This helped enhance students' motivation, and helped them keep concentration during class project.
8) By combining PDAs with LMS, it is very easy and convenient to keep and manage files and reports. There is no need to worry about losing tapes and papers, thus it is very supportive for the instructors with daily paperwork and evaluation.

Some weak points have been found such as:

1) Wireless LAN was sometime unstable, and it happened that some students were not able to upload their recorded files to u-Learning system by PDA. When that happened, a mini SD card was used to transfer data to the instructor's LAN computer. Through the LAN computer, it was safely uploaded to u-Learning system. Therefore it was not a serious problem except losing time. In order to solve this problem, Bluetooth might be an alternative.
2) In spite of a comparatively small-sized class of 20 students, as many as four technical staff came every time (four times in all). The students were quick learners, so they could manage to use them by themselves most of the time. Therefore it seems four staff coming every time was not necessary. But still, in most cases, it is likely that if students use PDAs for the first time in their lives, it might be difficult for the instructor to run the class without anybody's help. So if planned to use during the whole semester, it is suggested that in the initial class students get explanation on how to use, and then one assistant may be enough to attend students in case any trouble happens throughout the semester.
3) In relation to 2), this project could be carried out because the class size was relatively small. If it had been a large class, it might have been very difficult.
4) Implementation of PDAs for classroom use is very costly. The model used here, for instance, cost about 60,000yen (US$600) per each. Therefore it might be difficult for this project to be applied in emerging countries.

CONCLUSIONS AND FUTURE WORK

In this paper we have described the use of PDAs in Communicative English class, where the students conducted peer-to-peer interviews and interviews with international students. As for the students' free comments on PDA use in the survey, most students made favorable remarks (6 favorable comments to 2 unfavorable comments). But average satisfactory score on PDA use, 3.32 indicates that they somehow feel negatively about PDAs. In order to pinpoint negative factors, more detailed research would be necessary. Focusing on the use of PDAs with the university LMS, the following advantages and disadvantages were found:

Advantages

1) The recordability of PDA helped make an effective interactive learning.
2) Its usability (easy to record, quick start-up) helped make efficient use of class time.
3) Its mobility helped conduct interview session smoothly and successfully.
4) Novelty effect of new technology helped enhance students' motivation.
5) Digital recording by PDAs and uploading recorded files and summary reports to LMS helped save the instructor's time and labor to carry things like cassette tapes and papers.
6) Digitalization of both spoken and written English eased the instructor's concern about losing data.

Disadvantages

1) Unstableness of wireless LAN, which might not directly be related to PDA function itself, caused loss of class time.
2) Short duration of battery and bother of using stylus caused some user unfriendliness.
3) It was difficult to run the class without cooperation from some technical staff.
4) Its implementation is costly.

Since PDAs are not available in many universities or any other educational institution, mobile phones including smart phones are a strong alternative. According to the poll among 333 Japanese university students regarding their use of mobile devices by Thornton and Houser (2005), 100 percent reported owning a mobile phone. Since mobile phones usually function as a voice recorder, they can be used in place of PDAs. Then we do not need extra budget for running an interview class as proposed here. Mobile phone supported communicative English class is in preparation by the authors and is expected to be in progress soon.

It has been found that the use of PDAs supports effective running of the class. Nevertheless, its evaluation process still depends largely on the instructors' judgment by listening, remaining the same as when they judged by listening to the tapes. It is as time-consuming as ever. One solution is to make use of students' judgment. Collaborative learning methods which emphasize peer interaction have been getting much attention from researchers (Lan et al., 2007). Shared files of interviews in the LMS can be used as listening materials. Possible activities are listening, dictating, and voting for the best interviewer. The students listened to the interviews done by classmates with much interest. It was stimulative and enhanced their motivation. Shared files not only give good learning materials, but also will help reduce instructors' burden of evaluation if they take the students' voting results into account.

Among other things, human beings' intuitional judgment might lead to the wrong judgment. So it is necessary to develop an objective method of rating spoken English. It is reported that the use of Praat (open-source acoustic analysis software: http://www.fon.hum.uva.nl/praat/) helps the teacher by providing a method of pinpointing the weaknesses of each student (Wilson, 2008). More research on this field using Praat or WaveSurfer (http://www.speech.kth.se/wavesurfer/) is highly expected so that automated rating may be possible. In either way, it is expected that the use of mobile devices will lead progressive development in quality and quantity of communicative English class in the future.

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Current Practice in Mobile Learning: A Survey of Research Method and Purpose

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ABSTRACT
In this paper we present a survey of published research in mobile learning. We investigated 76 papers from mLearn 2007 and 2008, and classified them according to two dimensions: research method and research purpose. Research methods and purposes are important parts of how research is conducted. Alas, opinions and approaches towards research differ greatly. The classified papers are evenly distributed among the research methods investigated with one exception, being few in Basic research. In terms of research purpose, papers aimed to describe were well represented while there was a lack of papers targeting evaluation. Papers recounting both Basic research and research done to evaluate are imperative since they help a research field to mature and also help researchers to avoid repeating known pitfalls. This maturity, in turn, will lead to better scalability and sustainability for future research efforts in the community of mobile learning.

Author Keywords:
Method, Mobile Learning, Purpose, Review, Survey

INTRODUCTION

Naismith et al. (2004) define mobile learning as mobile technology that supports learning across locations, or learning that takes advantage of the opportunities offered by portable technologies. There has been a rapid growth in research, development, and deployment of mobile learning in recent years (Taylor et al., 2006). This rapid growth has led to a number of significant activities in schools, workplaces, museums, cities, and rural areas around the world according to Kukulska-Hulme et al. (2009). There are however a number of identified issues that need further attention (Sharples et al., 2008). The research conducted in mobile learning is often small scale and seldom developed into learning aids that are in wide use; hence we are faced with both limited scale and sustainability (Keegan, 2005). The field is compelled to evolve and find common ground in order to develop comprehensive principles and realistic visions, moving beyond specific implementations and branded technologies (Cobcroft et al., 2006). Traxler and Kukulska-Hulme (2005) conclude that only a few of the studies have been based on sound theory.

Mobile learning is still considered a young research field. The first research publications appeared in the late 1990s and the first international conference was held in 2001, called the World Conference on Mobile Learning, and in short mLearn. Vavoula and Sharples (2009) state that many of the influences, and in turn frameworks, methods, and tools, have been borrowed from other research fields, such as Technology-Enhanced Learning and Mobile Human-Computer Interaction. Influences from research fields such as Computer Supported Collaborative Work and E-learning can also be seen. Many researchers active in the field of mobile learning have backgrounds in Computer Science, Educational Studies, Information Systems, and Media Technology. The body of researchers includes both academics and professionals (e.g. educators and software developers).

A young research field is often highly opportunistic and technology driven. A primary focus is set on producing solutions and less attention is given to research methods and the execution of the scientific process. As mobile learning matures it is necessary to examine how this line of research is being conducted. At the same time we need to understand the impact of the technology and comprehend the knowledge that is produced. This introduces challenges to all aspects of mobile learning research. Vavoula and Sharples (2009) state that as the understanding of mobile learning deepens, the “borrowed” frameworks, methods, and tools might no longer be adequate and need to be processed and evolved. They in turn propose a framework built on holistic and systematic evaluation divided in three levels of granularity (micro, meso, and macro) to guide the data collection. Vavoula and Sharples (2009) also noticed that mixed methods are increasingly present in the design of evaluation for mobile learning. This can also be seen in terms of how the entire research process is conducted. Realizing and consciously being aware of the spectrum of research methods will, in the long term, allow us to influence the future direction of the research done in the field of mobile learning.

Emphasis on research methods and research purposes is important as these decide how research results are used and interpreted. Methods and purposes are also important because they help a research community to be built and allow this community to formally share results, and being an outlet for knowledge transfer. For instance, Traxler (2007) specifies that the significant challenges for research in mobile learning lies in scalability and sustainability, and therefore frameworks, methods, and tools need to respond to these challenges. Hence, it is necessary to have a thorough understanding of the fit between the approach chosen and the goal of the research. Wingkvist and Ericsson (2009)

suggest careful scaling according to pre-set specifications to increase the sustainability of research initiatives in mobile learning.

Discussing research methods and purposes is an integral and intricate part of scientific conduct. Initiators of this discussion were Wynekoop and Conger (1990), followed by Kjeldskov and Graham (2003), and later Jensen and Skov (2005). The classification schema presented within these papers demonstrates a usable and straightforward approach to enhance the discussion of research methods. In order to survey methods and purposes, the World Conference on Mobile Learning (mLearn) was selected as a prime subject for the appreciated publications accredited to mobile learning. The mLearn conference represents current practice conducted within mobile learning and highlights how research is carried out.

The rest of the paper is organized as follows, having this introduction followed by a presentation of eight well-established research methods and four research purposes. These provide the two dimensions of our survey, allowing us to review and discuss the results. We then present the classification and an interpretation of the results, and ending the paper with conclusions.

RESEARCH METHODS

In this section we present the eight research methods, including their strengths, weaknesses, and primary use in mobile learning research. The research methods are extracted from Wynekoop and Conger (1990) with supplementary input from references on research methods prominent in Information Systems (due to first author's background and main area of expertise). The methods considered are Case studies, Field studies, Action research, Experiment studies, Survey research, Applied research, Basic research, and Normative research. Research methods often overlap, so we emphasize the defining characteristics of each of the methods to show the classification of existing papers. The eight research methods are environment dependent, artificial, or environment independent (Benbasat, 1985). The first three methods, Case studies, Field studies, and Action research are used in a natural (real) setting and are environment dependent, while Experiments are carried out in a somewhat artificial setting. The remaining four (Survey, Applied, Basic, and Normative research) are all environment independent (but not artificial). This categorization of the eight methods is summarized in Table 1.

Method		Strengths	Weaknesses	Use
Environment dependent setting	Case studies	Process understanding Demonstrate Causality Natural setting Rich data	Costly, time demanding Limited generalizability No experimental control	Descriptions Explanations Generating hypothesis
	Field studies	Natural setting Independent variables manipulation Replicable	Difficult data collection Unknown sample bias No experimental control No guarantee of independent variable variation	Studying current practice Evaluating new practice Post hoc study of processes and outcomes in practice Generating hypothesis
	Action research	Firsthand experience Applying theory to practice Close relationship with subjects	Ethics consideration Researcher bias Time demanding Unknown generalizability	Generating hypothesis/theory Testing theories/hypothesis
Artificial setting	Experiment studies	Control of variables Replicable	Limited realism Unknown generalizability	Controlled experiments Testing theory/product
Environment independent setting	Survey research	Relatively easy, low cost Can reduce sample bias	Context insensitive No variable manipulation	Collecting data from large samples Providing statistic picture Developing hypothesis Testing relationships between factors Descriptive data collection
	Applied research	The goal is a product which may be evaluated	Solution constrained May need further design to make product general	Product development Goal-oriented hypothesis testing Testing hypothesis/concepts
	Basic research	No restrictions on solutions Solve new problems	Costly, time demanding May produce no solution	Building theory Solving new problems
			Solution may not match known problems	
	Normative research	Insight into firsthand experience Basis for other forms of research	Opinions may influence outcome	Descriptions of practice Building frameworks Informing and teaching concepts

Table 1. Summary of research methods (adapted from Wynekoop and Conger, 1990).

Case Studies

Case studies according to Yin (2003) are an example of an empirical enquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not evident. In respect of the researcher the boundary from the phenomena is distinct as the researcher is a passive and independent outsider. Case studies are often intensive evaluations of small size entities such as groups, organizations, individuals, systems, or tools. In general the data is collected by a combination of qualitative and quantitative methods such as observations, interviews, and questionnaires, with limited experimental or statistical control imposed. This often results in a complicated analysis, as the data collected in a natural setting is by default very rich and sometimes conflicting or incoherent. Case studies are on the other hand particularly well suited for research focusing on describing and explaining a specific phenomenon and for developing hypothesis or theory. However, case studies can be very time demanding and the findings hard to generalize upon. In mobile learning, case studies could be used to provide rich data explaining phenomena involving the use of mobile devices in a specific context.

Field Studies

Field studies are characterized by taking place in a natural setting, allowing the researcher a flexible stance in respect to variables, the degree of and manipulation of the same. However, as control increases over variables the pragmatism decreases. Using a range of qualitative and quantitative approaches, data is collected often through observations and interviews, supporting the study of complex situated interactions and processes as addressed by Klein and Myers (1999). The phenomena are placed in a social and cultural context. The advantage is the corpus of data, realistically extracted and in relatively short time period. The disadvantages are unknown biases, extensive data collection, and having no guarantee that the data is representative. In relation to mobile learning, field studies could be applied in current practice for either informing design or understanding the mobility of users, evaluating design or theory by conducting research in a realistic setting.

Action Research

Action research is particularly suited to application in an actual and natural setting; that is to study social and cultural phenomena. According to Baskerville and Myers (2004) the researcher actively participates in solving a problem while at the same time evaluating the results and making a knowledge contribution at large. For example, it allows the introduction, transformation, evaluation, and extraction of theories. The advantage of being so engaged in the activity facilitates first-hand understanding and supports the learning process for all those involved. However, the disadvantage is that it can be very time consuming, and since the researcher takes part in the phenomena studied, remaining at a critical stance can be hard. Even though the outcome is attached uniquely to the research conducted, it does offer a degree of external validity since others can interpret the theoretical contribution made. Nevertheless it can still be difficult to generalize upon. In relation to mobile learning, action research provides the perfect opportunity for a researcher to jointly collaborate with the "team".

Experiment Studies

Experiment studies are characterized by the researcher's ability to control dependent variables often by creating an artificial setting or situation. Being able to do this is prohibitively difficult or even impossible and a researcher often resorts to quasi-experiment studies as presented by Denscombe (1998). These usually take place in uncontrolled environments, variables from undetected sources are neither measured nor held constant, and these may produce misleading correlations between variables under study. Data can be collected depending on the style of the subsequent analysis desired. The major advantages of experiment studies are the opportunity to focus on specific phenomena of interest and a large degree of control in terms of manipulation of variables before and during the study through for example assignment of test subjects and exposure to different treatment variables. Also, well designed and executed experiment studies are highly replicable and facilitate data collection. Disadvantages include limited connection to the real world and an unknown level of generalizability of the results outside of the specific setting. In mobile learning research, experiment studies are suitable for evaluating design ideas, specific products, or theories about design and user interaction in controlled environments with little or no interference from the outside world.

Survey Research

Survey research provides information from a defined population and the data, which is gathered directly through, e.g., interviews, publications, and questionnaires, is assumed to be independent to the environment as stated by Fowler (2002). In essence, data from survey research is collected without the researcher's intervention or stake other than the gathering of data. Data is most often analyzed quantitatively, but data from interview surveys can also be analyzed qualitatively.

The advantages are that they facilitate large amounts of data to be gathered with relatively little effort, supporting broad generalization of results. Also a high level of control regarding sample subjects makes reduction of bias possible thus increasing validity. However, a disadvantage is that it suffers from providing only snapshots of studied phenomena and relies heavily on the subjective views of respondents. In respect to mobile learning, survey research could, for example, facilitate general information being gathered about user needs and requirements, or of a phenomenon, and from this develop an understanding of the current situation.

Applied Research

Applied research is similar to prototyping and based on a trial-and-error practice relying on the expertise and reasoning of the researcher's capabilities through intuition, experience, deduction, and induction. The outcome is known in terms of requirements, but not the method of obtaining the same as mentioned by Järvinen (2004). In line with this goal orientation, the advantage is that some kind of result being produced, and can be evaluated against the pre-set goal. The disadvantages are that the initial goal may be very limited and not generalizable, and that appropriate solutions for accomplishing the desired outcome may not be produced at all. Applied research is relevant for mobile learning in relation to design and implementation of systems, interfaces and techniques, which meet certain requirements for performance, user interaction, user satisfaction, etc.

Basic Research

Basic research allows the researcher to study well-known problems to which methods or possible solutions are yet to be identified. The aim is to find out what is part of reality and often the researcher is concerned with the development of a new theory (Järvinen, 2004). The approach is also trial-and-error based, riding on the competence of the researcher. The advantage is the directness of the research that is facilitated by the open choice of approaches and time, allowing a high level of creativity in the search for methods. The down side is that it can be very time consuming and there is no guarantee that a solution will eventually be produced. In relation to mobile learning, basic research may be applied to the development of theoretical frameworks for understanding fundamental principles, for example issues related to mobility or for identifying new problems related to learning while users are on the move.

Normative Research

Normative research is less rigorous in terms of research method per se though usually address interesting phenomena from a pragmatic standpoint. This is done in order to stimulate and indicate directions for future research, and for example covers writings of application descriptions, idea, concept, and suggestion development (Tolvanen, 1996). The narratives often seem intuitively correct but are not based on theory or research rigorously conducted, and are presented according to the style of a practitioner, i.e., giving a subjective view and focus on what worked in that particular situation. The advantage is that this kind of writing is more straightforward and often perceived easier to produce compared to presenting complex theoretical contributions. Drawbacks consist of limited theoretical foundation, weak methodological reflection, and low generalizability. However, the ones that reach the stage of publication often provide well-prepared arguments with considerable backing from other sources. For mobile learning, the papers describing general statements or designs, and procedures that worked well or did not prove successful, are representative.

RESEARCH PURPOSES

In this section the research purpose is defined as the second dimension of the survey. The purpose of a research effort is closely linked to the research method used and vice versa, so these two notions make an excellent pair when attempting to classify mobile learning papers. The definitions of the four research purposes are inspired by Wynekopp and Conger (1990), although a slight refinement was made. The original categories were: Understanding/Describing, Engineering, Re-engineering, and Evaluating. We divided Understanding/Describing into two categories and merged Engineering and Re-engineering into one category called Developing. These changes were done first to differentiate between Understanding and Describing in order to sharpen the categorization in respect of each other, and secondly to merge the other two because mobile learning application and framework have not been around long enough to fully use the categorization of re-engineering. In lieu of this the categories for research purposes are: Describing, Developing, Understanding, and Evaluating. These four research purposes are explained and defined here:

Describing refers to writings that describe the unit under study, such as features of the portrayed environment, the technical implementation, often represented in models of low level of abstraction. Describing papers provide knowledge about the research in a straightforward manor with emphasis on actual results.

Developing refers to writings that define frameworks, be it technical or theoretical, and emphasis on development and the presentation of solutions. A typical example is when the aim is to develop a new conceptual model or a prototype, i.e., papers that basically provide first hand knowledge in uncharted territory.

Understanding refers to writings that seek to understand and make sense of conducted research, while trying to bridge the result into a theoretical frame, often present new constructs based on identifying and enhancing theory. Understanding papers provide knowledge of a wider theoretical setting, often found in research that is in the process of rethinking something.

Evaluating refers to writings that evaluate the usefulness, benefits and shortcomings of the research, while hopefully giving pointers to other researchers. These papers can be seen as evaluating methods and purposes in practice and reflecting upon these, i.e., provide knowledge about lessons learned, which can give a head start or at least the possibility to avoid pitfalls.

These four categories of purpose along with the methods are used in the next section as a basis for classifying mobile learning research papers from two World Conferences on Mobile Learning, mLearn 2007 and mLearn 2008.

CLASSIFICATION OF MOBILE LEARNING RESEARCH

The proceedings of mLearn 2007 (Norman & Pearce, 2007) and mLearn 2008 (Traxler et. al., 2008) were selected to get a picture of current practice in mobile learning. Traxler (2007) proclaims that the mobile learning community is currently visible mainly through dedicated international conference series, of which mLearn is the most prestigious, rather than through any journals. The mLearn conference series is renowned for including contributions from academics as well as practitioners. All the 76 full papers from mLearn 2007 and 2008 were classified. The papers are numbered in the order they are printed in the conference proceedings with the first paper from mLearn 2007 as paper #1 and the first paper from mLearn 2008 as paper #39 (cf. Appendix). The data set as defined by Robson (2007) is the set of papers from mLearn 2007 and mLearn 2008, which provides a solid and adequately representative basis for this survey. Each paper was peer reviewed, which indicated that the published papers are of good quality and of importance to the community. 76 such papers is a relevant and sufficiently large sample to draw conclusions from.

Initially the first author reviewed all papers. Each paper was thoroughly read with particular focus on identifying the purpose of the presented research as well as the method applied to accomplish the research. Many papers can be classified as having a number of purposes or methods, but the most coherent and dominant from each category were selected to classify the paper according to the two dimensions, respectively. Moreover, an international master's student repeated the same classification process. The results of the two classifications were compared and a final decision was made for each paper. This decision was then discussed and collaborated by the second author, who now also read all the papers. The complete survey result of the 76 papers is presented in Table 2, including the total share of each category in percentage.

	Case studies	Field studies	Action research	Experiment studies	Survey research	Basic research	Applied research	Normative research	Total (in %)
Describing	1, 3, 6, 11, 22, 29, 32, 37, 40, 45, 50, 66, 70	2, 12, 28, 39, 59	49, 54, 71	16, 17, 27, 31, 73	8, 38, 41, 53, 76		5, 15, 24, 34, 56	4, 9, 19, 23, 25, 33	55.26%
Developing	10	57		13	69		7, 20, 21, 26, 36, 46, 60	14, 18, 43, 44, 51, 52, 68	23.68%
Understanding	55, 58, 67, 74	47	64		42, 48, 63, 65	35		72, 75	17.11%
Evaluating					62		30	61	3.95%
Total (in %)	23.68%	9.21%	5.26%	7.89%	14.47%	1.32%	17.11%	21.05%	100,00%

Table 2. Classification of mobile learning research papers.

Table 2 shows that the most commonly used method within mobile learning research is Case studies, with 24% (18 out of 76) of the papers. The second most used method is Normative research, which 21% or 16 out of 76 papers used. Applied research and Survey research are also commonly used; the former was used by 17% of the papers while the latter was used by 14%. Of the less generally used methods, Field studies and Experiment studies are more common, with 9%, and 8% respectively, while Action research was used by 5% of the papers. Only one paper was classified as Basic research. The classification shows that environmental independent research (Survey, Basic, Applied, and Normative research) dominates and was used by 54% of the papers. 38% use environment dependent methods (Case studies, Field studies, and Action research) and focus on studying real use in a natural setting. 8% of the papers use an artificial setting (Experiment studies). In environmental independent research, Normative research was the most common method, closely followed by Applied research (39% respectively 31%). Case study dominated the environment dependent methods and was used by 62% of the papers. By definition, 100% of the artificial research used Experiment research.

In Figure 1 the papers are first divided by environment and secondly by method to show the number and percentage that cover each category. The most common purpose of the research was to describe the study (Describing), with 55% (42 of 76). This was followed by Developing and Understanding, 24% (18 of 76) and 17% (13 of 76), respectively. Only 4% (3 of 76) of the papers had Evaluating as their research purpose. Research with the purpose of Describing most commonly

used Case study as the research method. This was used by 31% of the Describing papers. The rest of the Describing papers were almost equally distributed among Experiment, Survey, Applied, and Normative research (12% for the first three, 14% for the last), while 7% of the papers used Action research. The papers with a purpose of Developing usually used Applied or Normative research, and 78% (39% each) of all the Developing papers used either of those two methods. The remaining 22% were equally divided between Case study, Field study, Experiment study, and Survey research. The Understanding papers were most commonly either Case studies or Survey research (31% each). The remaining papers used Field studies, Action research, or Basic research (8% each). The three Evaluating papers were divided into using Survey research, Applied research, or Normative research.

The Case study research method was most commonly used for the Describing purpose. 72% of the Case study papers fall within this purpose. Similar results hold for Field studies, Action research, and Experiment studies, where 71%, 75%, and 83% of the use of these methods is done with the purpose of Describing. The remaining methods, apart from Basic Research, are generally used for two purposes, e.g., Survey research is most commonly done either for Describing or Understanding, with 45% and 36% respectively.

Figure 1. Papers divided by environment (left) and method (right) in percentage.

Within mobile learning there is a tendency towards research in an independent environment aiming at Describing and Developing. In the environmental dependent category Case study dominates with 62% (18 papers) and for all the 29 papers in that whole category, 21 papers have the purpose of Describing. Understanding (and presenting theoretical framework) is the focus of 13 papers (17%), which limits the body of knowledge for mobile learning. Of the 13 papers of Applied research, 93% do so for the purpose of Developing and Understanding. Of the 6 papers in the Experiment category, 83% (5 papers) use this method for Describing purposes. Of the 7 papers that report Field studies, 5 papers use this method for Describing purpose, while 2 papers use it for a Developing and Understanding purpose, respectively. Applied and Normative research is most commonly used for Describing or Developing. In the case of Applied research, 38% of the papers utilizing this method are Describing, while 54% are Developing. In the case of Normative research, 38% are Describing, while 44% are Developing. The sole paper that used Basic research used it for Understanding.

DISCUSSION

This section presents an analysis of the results of the classification presented in the previous section. Generally, the research conducted is either close to one situation in particular, gathering empirical data, or on a normative level presenting ways to utilize the essence of mobile learning in an abstract sense. These two represent opposite ends of the spectrum given method choice and purpose and out of the 76 papers considered in this survey, 51 papers fall into either of these (67%). This proves the need for a broader scope in terms of methods and purposes to help the research field to mature and also help researchers to avoid repeating known pitfalls. This maturity, in turn, will lead to better scalability and sustainability for future research efforts in the community of mobile learning.

Mobile learning is evidently an interdisciplinary field with ties to for example Computer Science, something that might explain the emphasis on Applied research and data gathering. Methods used in related fields, e.g., Information Systems and Software Engineering are also noticeable within mobile learning, for instance with Action research, Case studies, and Field studies. A difference compared to these related disciplines, however, is the lack of artificial environments and Experiment studies found in this review of the papers. From the 76 papers, only 6 presented some kind of Experiment studies. In some of the related fields, experiments are more common, for example Kjeldskov and Graham (2003) show that Experiment studies is the second most common research method used in Mobile Human-Computer Interaction. This divergence may be a result of the difficulty to emulate aspects of mobile learning, such as mobility and the dynamics of context changes in an experimental setup. Field study, on the other hand, offers an ideal opportunity for the study of rich real-world cases. Mobile learning is applicable and well understood in a natural and environment dependent setting. The use of research methods such as Case study and Action research aids and strengthens the result when studies are conducted. Mobile learning researchers could learn from other disciplines that have struggled with the study of similar phenomena often depending on the degree of involvement from the researcher. Experimental studies and the use of control groups are subsequently essential.

The prevalence to gather empirical data and the research that is conducted to describe a phenomenon shows a strong connection to real-world cases. Much of the research conducted is done to describe how the real world works and is often presented as the result of a small-scale study where a population used mobile learning technology. This data is presented, not interpreted, and offered as a description of the process. On the other end of the spectrum there is the normative research that is also done with the purpose to describe and develop. Many of the papers that fall into this category present either a description of a current situation or a future situation describing what may happen or how something should be developed. These papers are based on some evidence and are generally visionary. Between these two, Basic research, and Evaluating research is expected, but not found. Out of the papers reviewed, 4 fall into either of these categories, none in both.

There is a distinct lack of Evaluating and Basic research among the papers reviewed. The one paper we found in Basic research is mirrored in the survey of Jansen and Skov (2005) that also only found one such paper in relation to their field (Children's Technology Design). Many of the papers include an attempt at reflection. This is often not the purpose and almost always leads to the evaluation from an end-user perspective. There is little reflection by revisiting results, or evaluation of the effort compared to other efforts. This is a problem. In a similar manner, much of the research is done to describe, not understand or evaluate. This may indicate a lack of maturity, a lack of a clear definition of the field. There is still a need to describe how it works in order to define it. There is a need to bridge the gap between descriptive small-scale research and normative visionary research, by evaluating and trying to understand. This is where the knowledge is produced and theories are formed.

One reason for the lack of Evaluating and Basic research might be the speed in which mobile technologies are developed and improved upon. A generation of mobile devices is short-lived, which may result in many technical aspects being lost when a new generation is introduced or many studies feeling outdated and old, which in turn may affect evaluations and reflections. This lends well to simply stating facts or presenting visionary plans. However, without proper focus on the research process, including methods and purposes, it is hard for research in mobile learning to transfer already obtained knowledge into the starting point for new efforts.

One way to describe the papers reviewed is to consider some of them as standing on the frontiers looking into the future and others working hard to keep up with the development. A challenge for mobile learning research would be to stop, turn around, and reflect over the results once again. This is the way to reach the visionary future, which is predicted by looking ahead avoiding already known pitfalls. Also, a head start is given if research is built upon previous research instead if the wheel is reinvented every time a new mobile learning initiative gets on its way.

Given this review it must be stated that research methods and a classification of research according to defined methods is not an exact science. Some definitions can be considered vague or even overlapping with other methods. To make issues even more complicated, few papers contain a discussion of the exact methods used, so in many cases it is up to judgment calls. With the overlapping and vague methods it was sometimes hard to pick one, and only one, method. For example, is a study conducted in a natural setting but with all variables fixed a Field study or an Experiment?

Further along these lines, it should be acknowledged that the survey presented in this paper has some limitations. It can for example be discussed if the research papers presented at a conference although marketed central to the field is really representative of the research and activities that are conducted within the field. Furthermore, it is not always easy to compress the research to fit the page limitations or topics of interest at a conference. The conference series selected for this review provides papers from a wide range of researchers and research projects. The authors read each paper several times, and carefully discussed the method and the purpose before it was classified. However, the purposes and methods matrix, as classification tool, has been used for a number of similar publications. Further, the results of the classification in this paper show a clear trend that is difficult to attribute to vague method definitions. Based on these observations, the authors of this paper are confident that the research conducted is of value, even with the limitations placed on it.

CONCLUSIONS

Research methods and research purposes are an integral and intricate part of how people conduct research. In this paper we presented a two dimensional matrix where we compared research methods and research purposes in a selection of 76 papers. The first dimension consists of eight research methods: Case study, Field study, Action research, Experiment, Survey, Applied research, Basic research, and Normative research. The second dimension consists of four research purposes: Describing, Developing, Understanding, and Evaluating. The 76 papers we investigated represent a broad selection within current practices in mobile learning.

Our classification shows an even distribution in respect to research methods, with only Basic research being under-represented. In terms of research purposes, Describing is the most frequent used within more than half of the papers, followed by one-fourth of Developing papers, and one-fifth Understanding. Evaluating, on the other hand, is represented only within about one-twentieth of the total amount of papers we have investigated. Our survey reveals that there is a clear lack of Basic research and Evaluating papers. This obviously indicates a void that could be filled with publications specifying lessons that were learned, describing benefits as well as shortcoming of research already conducted.

In a young and evolving research field it is necessary to try new research methods, which in turn can greatly improve the diversity of the research published. Mobile learning is an excellent example of an evolving field where researchers apply various methods and practices to solve their problems. Our survey shows exactly that and our findings further present a

number of opportunities for future research. We suggest that researchers revisit and evaluate their research methods. This can lead to evolvement and presentation of new frameworks, methods, and tools. This holistic approach and systematical description is important not only for method and purpose in research but also for improving the overall system development process that mobile learning research is faced with.

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The mPortal: Supporting Collaboration to Develop mLearning Strategies for Educational Transformation

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ABSTRACT
This paper proposes the establishment of an online portal to influence and support best practices in mLearning. With the growing interest in mLearning to address the learning styles of a generation of students who have grown up with digital technology, and the adoption of mobile technology by Indigenous peoples and in developing countries, there is a need for an accessible body of knowledge of mLearning principles, teaching strategies and case studies. An mPortal would foster collaboration between researchers and educators and inform emerging national and international approaches to using mobile technologies at all levels of the education sector and across all disciplines.

Author Keywords
mLearning, educational change, portal, experiential learning, sustainability, cultural diversity

INTRODUCTION

In the first decade of the twenty-first century, interest in mLearning – learning facilitated by mobile technologies – has flourished (Naismith, 2004; JISC, 2005; Watson and White, 2006; Pachler, 2007). This has come about most obviously because of the availability of wireless technologies but also, in large measure, from a realization that there is a serious mismatch between traditional educational methods and the current generation of learners.

mLearning represents a significant departure both from traditional didactic teaching practices and from eLearning. In the 1990s the convergence of personal computers and the Internet into networked, multimedia communication and information systems supported the growth of online educational practices and services. However eLearning did not, with honourable exceptions, revolutionize pedagogic practices, as was optimistically foreseen in the early 1990s. For many lecturers, despite the initial promise, eLearning has degenerated into the online provision of learning resources to be downloaded by the student. This gives flexibility and convenient access to lecture slides and notes for both distance and on-campus students, but also leads to a perpetuation of the old didactic paradigm of education, where the student absorbs and regurgitates what the teacher has transmitted to them. In Figure 1, we see this illustrated in a delightful French drawing from 1910, foreseeing the world in the year 2000: students sit passively downloading information that has been "digitized" in the teacher's book-mincer "server". The lack of expression on the students' faces indicates that little learning is happening. Today, inactive, didactic lectures, and its online equivalent, remain the dominant mode of instruction.

As a "disruptive" new technology mobile devices have an interesting potential to support new learning and teaching practices. Mobile devices are increasingly Internet-enabled and are changing contemporary definitions of what is the "workplace" and what is a "learning space", in fact what constitutes learning (Kukulska-Hulme and Traxler, 2005; Adesope, Olubunmi and McCracken, 2007). mLearning is "spontaneous, personal, informal, contextual, portable, ubiquitous (available everywhere) and pervasive" (Kukulska-Hulme, in Kukulska-Hulme and Traxler, 2005, p. 2).

In this paper we explore how the existing knowledge and experiences of mLearning practitioners might be leveraged by the better use of collaborative web-based technologies. We firstly discuss how mLearning can revitalize the learning not only of the "digital natives" generation but also of previously disenfranchised groups of learners. We then present our proposal for an mPortal to serve as a catalyst for change in the educational sector.

MLEARNING FOR IMPROVING THE EDUCATION OF THE DIGITAL NATIVES GENERATION

The average university student of today has grown up with digital technology and has spent far more time playing video games, browsing the Internet, sending text messages and watching television than reading books. Prensky (2001), who dubbed these students "digital natives", noted their immersion in the digital world and their constant interaction with it, resulting in a fundamental change to the way they think and the way they process information. Their learning is "short burst, casual, multi-tasking" (Prensky, 2004). They are experiential learners, acquiring new knowledge by doing and through discovery, rather than by passively being told; they like social interactivity and working in teams; they are permanently connected; and are visual communicators, responding better to image-rich environments than to text (Oblinger and Oblinger, 2005). Even some critics of the digital native concept have shown that levels of mobile technology ownership and use are very high (Kennedy, Judd, Churchward, Gray and Krause, 2008). Student ownership of mobile phones in Australia, for example, is over 95%, with the most common uses being text messaging and telephoning. Students' mobile habits are interesting for what they can tell us about how to increase students' engagement in their learning and make education more relevant and meaningful (Oliver and Goerke, 2007).

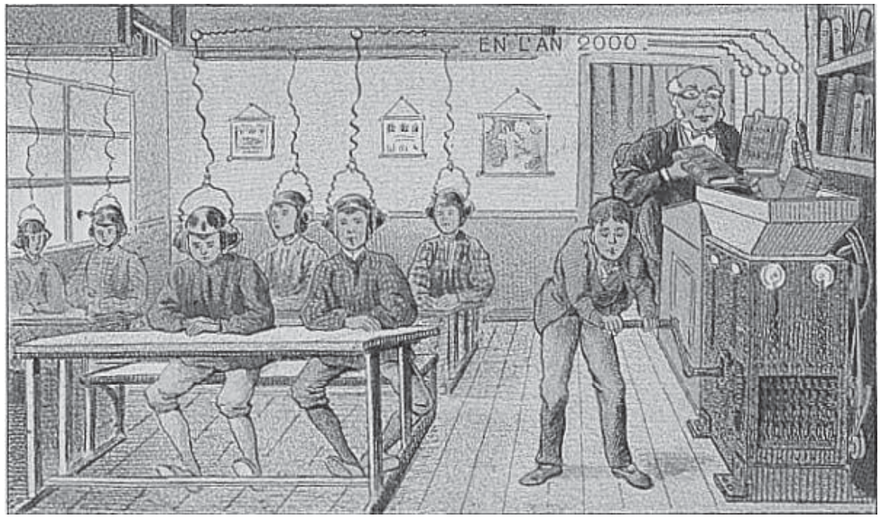

Figure 1. Educational technology in the year 2000, as viewed in France in 1910.

<http://www.paleofuture.com/2007/09/french-prints-show-year-2000-1910.html>

By contrast with both traditional teaching and eLearning, mLearning fits well with the learning styles of the digital natives' generation in a number of ways (Litchfield, Dyson, Lawrence and Zmijewska, 2007). Firstly, many studies in the literature demonstrate how mobile technology can improve interactivity in the classroom. Clickers, PDAs, laptops, tablet PCs and mobile phones can all be used to enhance classroom interactivity in lectures (Fies & Marshall, 2006; Fujimura and Doi, 2006; Lindquist, Denning, Kelly, Malanai, Griswold and Simon, 2007; Dyson, Raban, Litchfield and Lawrence, 2008). Lecturers can test students' knowledge, ascertain levels of satisfaction with the teaching materials and methods, and conduct experiential learning using game-like sessions (Goh and Hooper, 2007). The students use their mobile devices to provide responses in the class. Replies given by the students are collected and instantly displayed to the lecturer and, if appropriate, to the class, allowing immediate feedback to the students and discussion (Litchfield, Raban, Dyson, Leigh and Tyler, in press).

Secondly, mLearning can answer the digital natives' expectations of connectedness. A number of studies have shown how mobile technology can increase students' access to learning materials anywhere, anytime either through podcasts or wireless access to websites (Barbosa, Hahn, Barbosa and Geyer, 2007; Cao, Tin, McGreal, Ally and Coffey, 2006).

Moreover, mobile devices lend themselves to learning in context through mobile-supported fieldwork and training (Sommers, Hesler & Bostick, 2001; Sharples, Corlett & Westmancott, 2002). Prosser and Trigwell (1999) have shown that improving students' perceptions of the learning context improves their approaches to learning, and leads to higher learning outcomes. Mobile devices can support students' knowledge discovery in the field through providing access to reference materials, maintaining a communication channel between fieldworkers and off-site teachers and support, and through data capture (Dyson, Lawrence, Litchfield and Zmijewska, 2008). Because mobile devices are increasingly equipped with cameras, videocams and sound recorders, data capture in the field can be in a variety of media formats, including photographs and video recordings, more appealing to the digital natives' generation.

MLEARNING FOR DIVERSITY

Universities serve an increasingly diverse student body. In many English-speaking countries there are large cohorts of international students, most of whom have English as a second language and whose special needs for learning in a new environment need to be better addressed. Mobile learning can meet the requirements of the international and non-English speaking background student population by allowing them to review lectures, messages and other content outside normal classroom hours (Nataatmadja and Dyson, 2008).

Beyond the university sector, there has been a realization that mLearning can work with previously disenfranchised groups in society. This has resulted from the almost ubiquitous adoption of mobile phones across all social strata and hence a widespread familiarity with the technologies and the forms of interaction which they promote. In Europe,

interesting mLearning and training projects have been implemented in Romany communities, for refugees and recent immigrants, adult literacy and numeracy learners, and hard-to-reach workplace learners (Stead, 2005). In Australia, mLearning has been successfully demonstrated with young people with poor employment histories, records of incarceration or other backgrounds of disadvantage (Ragus, Meredith, Dacey, Richter, Paterson and Hayes, 2005).

Oral communication has particular resonances for Indigenous people and we should therefore not be surprised to find that Indigenous communities who have access to mobile networks in Australia, for instance, have fairly high rates of mobile phone adoption, much greater than any other information and communication technology (ICT) that has previously been made available to them (Brady, Dyson and Asela, 2008). For example, mobile phone ownership amongst Aboriginal people in Alice Springs was 56% according to one 2006 study (Tangentyere Council and Central Land Council, 2007). To date there appear to have been no implementations of mLearning specifically for Indigenous people. Given their greater familiarity with mobile technology compared with desktop computers, mLearning would have advantages over eLearning for this group.

Similarly in developing countries, mobile phones have had a much greater impact than any other form of ICT. For example in Africa, more than 70% of the telecommunications services consist of mobile technology and the continent is the fastest growing market in the world (Dyson, 2007). Mobile technology is transforming the way advocacy, development and relief organizations accomplish their institutional missions (Kinkade and Verclas, 2008; EpiSurveyor Project 2008; UN Foundation 2008). In these countries, mLearning has a huge potential to allow educational institutions and their students to bypass eLearning, with its dependency on desktop computers and fixed-line and electricity infrastructure, and move to a technology which is widespread, cost-effective and which people know how to use. mLearning is currently very limited in the developing world but Traxler and Kukulska-Hulme (2005) report on two promising cases: the ZMQ Project in India, which uses mLearning materials to educate poor villagers about health issues; and the School Empowerment Programme in Kenya, which employs bulk SMS messaging for in-service training of primary school teachers and local support personnel.

THE NEED FOR AN MLEARNING PORTAL

Despite the potential of mLearning to transform the way we deliver education, and despite many successful mLearning projects, there remain unresolved issues. We can say that mLearning is in an exploratory, experimental phase since few institutions have adopted large-scale, sustained implementations. Interviews of professors at eight universities in Australia, New Zealand and the USA conducted by Al-khamaysah, Zmijewska, Lawrence and Culjak (2007) showed that none had adopted mLearning, despite widespread use of eLearning. Most surveys of students show that few use their mobile phones for learning – only 1 in 6 according to Pettit and Kukulska-Hulme (2007). Educators are still working out how to do it, how to finance it, which subjects and groups of students might benefit most, and how to get academics on board. Traxler (in Kukulska-Hulme and Traxler, 2005, p. 70) sees mLearning as "approaching a critical phase in its development when its advocates must address the twin issues of 'blending' with other forms of delivery – both traditional and electronic – and of devising sustainable, reliable, generalized and large-scale formats across whole departments and institutions." The question, then, is how to scale up from the small, experimental projects that have been the focus of mLearning up to this time.

One answer suggested by Prensky (2005, p. 1) is to facilitate the exchange of information by teachers already using mobile technology in interesting ways: "If our goal is to bring schools and classrooms into the 21st century before that century ends, we need to take advantage of the large amount of innovation *that is already going on* in many classrooms by allowing our teachers to share it." The most obvious vehicle for sharing insights into mLearning is the Internet.

However, even on the Internet, it is possible for resources to be fragmented and difficult to locate. For example, there are various research groups, online journals, conferences and educational software companies who have already established websites providing either free or paid access to articles about, and products for, mLearning. An example is the website of the London Mobile Learning Group, which primarily hosts articles, presentation slides and notices of symposia by group members. Few of these websites are linked. In addition, these existing websites generally shy away from collaboration by falling into what Feenberg and Bakardjieva (2004, p.1) define as a "consumption" model rather than being true online communities: items are disseminated like an online library in which "Users scarcely talk to each other … and never see or sense each other's presence." Furthermore, many important issues in mLearning, such as the use of mLearning to support the development of graduate attributes, sustainability and cost effectiveness of mLearning approaches, the needs of diverse groups of learners and of developing countries, are often overlooked.

To remedy this situation, we propose the establishment of a collaborative mLearning portal – the mPortal – freely accessible through the Internet. Portals – websites which offer an entry point to a range of services and resources collected into one convenient, online location – have long been used effectively in business (Hazra, 2002). In the education field, portals have most often been employed to provide access to digital libraries (e.g., Impagliazzo, Cassel and Knox, 2002). The proposed mPortal would provide a single, centralized location for collaboration in mLearning, with links to existing mLearning resources and webpages. This would foster best-practice in mLearning, provide professional development for teachers in this emerging field, and lead to a renewal of teaching methods to suit the needs of today's students.

The emergence of the Web 2.0 technologies provides an excellent opportunity to make the mPortal truly collaborative. Beginning as tools largely for popular, mass intercourse on the Web, blogs, wikis, photo- and video-sharing technologies, and other social media are now being incorporated into some institutional frameworks to encourage greater public involvement, a two-way dialogue and a sense of community (Russo, Watkins, Kelly and Chan, 2007). The Internet user is no longer positioned as a mere consumer of content, but as a dynamic participant, shaking off the passivity of what McLuhan (1962) called the Gutenberg heritage. Web 2.0 is about "moving beyond content delivery to personal publishing, ease of use, interactivity, collaboration, sharing and customisation" (Cochrane, 2006, p. 144). The incorporation of these tools will enable the mPortal to engage in many-to-many communication with the mLearning community rather than the top-down, one-to-many approach that is the norm on most educational websites currently in existence. This conversation will result in the co-creation of knowledge about mLearning by its practitioners and its dissemination to those who have not yet begun this journey. The reliability and authoritativeness of this body of knowledge will be supported through online discussions, peer review and interactive critical debate.

UNDERLYING PRINCIPLES

Three important foci of the mPortal include:

- The need to develop good quality learning experiences for our students which involve active, experiential learning.
- The need to ensure that mLearning is inclusive of all learners. To maximize global learning outcomes, the mPortal will investigate issues of learner cultural diversity in the context of increasing internationalization and globalization of education and the increased need for an educated and flexible workforce. Faced with a diversity of populations and needs, the notions of multiculturality and interculturality are becoming key aspects of curriculum design and change (Germain-Rutherford and Kerr, 2008).
- The importance of containing costs so that universities are not afraid to move from short-term pilot projects to the full implementation of mLearning into mainstream courses over the long-term. Cost has been proposed as a major, but not insurmountable hurdle, to greater sustainability in mLearning (Dyson, Raban, Litchfield and Lawrence, 2008).

OBJECTIVES OF THE MPORTAL

The mPortal's main, global mLearning objective is to:

1. Influence and support the design, development, implementation and evaluation of mLearning professional development and effective curriculum and program integration for educators. This includes a focus on enhancing active, experiential learning using sustainable and cost-effective strategies for culturally diverse learners.

In a co-ordinated approach, this mLearning outcome will be achieved through the following:

2. Develop an online body of knowledge of mLearning principles, teaching strategies and case studies for enhancing active experiential learning by encouraging sharing and collaboration between members of the mLearning community of educators and researchers.
3. Share insights and strategies for achieving sustainability in mLearning through the use of cost-effective strategies such as the employment of students' own mobile devices, existing university wireless networks and low-cost data transmission modes.
4. Investigate best-practice mLearning curriculum design and integration support that address learners' cultural diversity and equity issues.
5. Actively promote effective mLearning activities which meet the needs of Indigenous communities for education, cultural renewal and the removal of disadvantage.
6. Foster the collaboration and exchange between educators in the developed world and in developing countries to work towards greater equality across the globe.
7. Promote curriculum renewal through the collection of mLearning resources which focus on the effective development of graduate attributes as well as major issues of current concern, such as environmental education.
8. Offer a vehicle for effective professional development activities, mentoring, peer support, and promote professional development events which focus on mLearning.

COMPONENTS OF THE MPORTAL

Components of the mPortal, accessible either from a computer or mobile device, are shown in Figure 2.

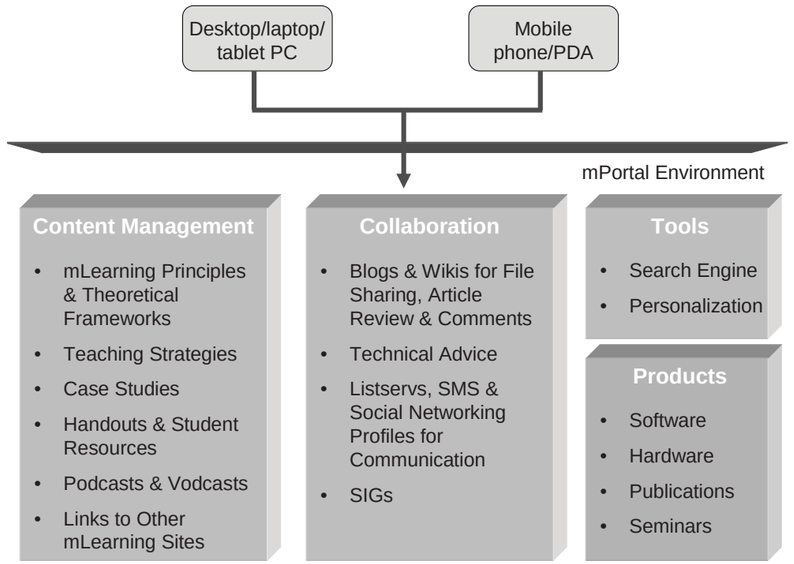

Figure 2. Components of the mPortal.

Components include:

Content Management

- mLearning principles and theoretical frameworks, aimed at developing a more rigorous theoretical underpinning of mLearning than has existed to date.
- Effective mLearning teaching strategies.
- Case studies organized according to commonly accepted areas of mLearning (e.g., interactive classroom, podcasting, mFieldwork, workplace training using mobile devices), and according to areas of importance, specified above, such as sustainability, cultural diversity in the students body, Indigenous learning, environmental studies, etc.
- Handouts, mobile files and other practical resources for students provided by participating educators.
- Links to a wide range of existing mLearning websites and online articles.

Collaboration

- A variety of Web 2.0 tools to support collaborative work, feedback and comment, sharing of documents or technical tips.
- Specific areas of mLearning, as detailed in Case Studies above, would be supported by Special Interest Groups (SIGs), each with their own blog, wiki, etc.

Tools

- An insite search engine to allow rapid location of desired information and resources.
- An optional personalization and log-on function, whereby a registered user can enrol in their topics of interest, allowing articles and special-interest group blogs to be presented to them without searching.

Products

- Online sale and advertizing of a range of products to provide the income to help make the mPortal sustainable.

CONCLUSION

The extraordinary growth in ownership of mobile devices in all nations presents a wonderful opportunity to improve educational outcomes right across the world by enhancing active, experiential learning through the appropriate use of mobile technology. The availability of relatively low-cost mobile devices, such as mobile phones, PDAs, iPods and MP3 players, has created new global access and learning opportunities. This can improve the quality of learning both in formal academic locations but also in economically and socially marginalized communities and in the developing world.

The mPortal would promote innovation in mLearning and its more widespread adoption by increasing the visibility of those already working in this area and promulgating the results of their experimentations (Rogers, 1973). By providing a vehicle for sharing insights and the lessons of experience, it would overcome the reluctance of some to try this new educational technology, giving much needed support and encouragement, and removing some of the complexity that is always a hurdle in the adoption of new ways of teaching and learning. We envisage that it will be a catalyst for change, developing new pedagogies relevant to our students' learning needs and advancing education into the twenty-first century.

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From Research to Large Scale Implementation: Ensuring and Demonstrating the Effectiveness of Mobile Learning

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ABSTRACT
The Mobile Learning Network (MoLeNET) initiative is a deliberate attempt to move mobile learning from the realm of research and development into mainstream teaching and learning. This large implementation has explored the contribution mobile learning can make in diverse contexts. It aims to improve teaching and learning and learner outcomes, to assess the effectiveness of mobile learning and to build mobile learning and research expertise capacity. Tools used to achieve these aims include an innovative funding methodology, large scale quantitative research and action research. The findings of the research in 2007/08 have been very encouraging and both the initiative and the research are continuing.

Author Keywords
Implementation, further education, main streaming, capacity building, action research, quantitative research

INTRODUCTION
The Mobile Learning Network (MoLeNET) which is certainly the UK's, and possibly the world's, largest and most diverse implementation of mobile learning is the result of a deliberate attempt to move mobile learning into main stream teaching and learning. The initiative's aims also include using new and emerging technologies to enhance teaching and learning and contributing to addressing the shortage of mobile learning experts and experienced practitioners, particularly in the Further Education (FE) sector whilst generating good practice exemplars.

In a collaborative approach, unique to those involved, participating colleges and schools together with the English Learning and Skills Council (LSC), the body responsible for funding all post compulsory education except universities, are sharing the cost of projects introducing or expanding mobile learning. They have invested over £12 million during 2007-2009.

LSC provide capital funding and the participating institutions fund the provision, by the Learning and Skills Network (LSN), of the MoLeNET Support Programme which includes advice, learning materials, training and continuing professional development (CPD), mentoring, provision and facilitation of systems for on-line peer-to-peer support, networking and resource sharing.

The programme also includes a Research and Evaluation strand which investigates how the colleges and schools involved use mobile learning to improve teaching and learning, the impact of mobile learning on learners, teachers and institutions and whether mobile learning can help to improve retention, achievement and progression of learners. The research approach used is also intended to encourage embedding of mobile learning into practice and systematic evaluation of its impact.

32 MoLeNET projects started in the 2007/2008 academic year and 30 in the 2008/09 academic year. 115 colleges and 29 schools have been, involved in MoLeNET to-date. Approximately 10,000 learners were involved in 2007/08 and around 20,000 learners will have been involved by the end of the 2008/09 academic year together with more than 4,000 staff.

MoLeNET uses a broad definition of mobile learning i.e.: The exploitation of ubiquitous handheld technologies, together with wireless or mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning.

The mobile technologies used by the projects include personal digital assistants (PDA)s, mobile phones, smartphones, MP3/MP4 players (e.g. iPODs), portable multimedia players, handheld gaming devices (e.g. Sony PSP, Nintendo DS), Ultramobile PCs (UMPCs), mini notebooks/netbooks (screens less than 9 inches), handheld GPS and voting devices and specialist portable technologies used in science labs, engineering workshops or for environmental or agricultural study.

BACKGROUND
Early in 2007 the senior e-learning policy advisor at the LSC became convinced that mobile and wireless technologies were sufficiently stable, and the concept and practice of mobile learning well enough established, to justify significant investment in a substantial implementation of mobile learning within the English Further Education (FE) sector.

Evidence for this had been provided by the findings of several research and development projects over a number of years and the successes of a number of pilots including most notably Wolverhampton Council's Learning-2-Go initiative (Perry, D 2006) which had introduced mobile learning into primary and secondary schools. The LSC had provided support for the Learning and Skills Development Agency (LSDA) which led the first major mobile learning project

supported by the European Union “m-learning” (2001-2004) (Attewell. J 2004) and for a subsequent LSDA project which trialed a mobile learning teachers toolkit in FE colleges (Savill-Smith, C et al. 2006).

THEORY

The Research and Evaluation strand of the MoLeNET programme employs a range of both quantitative and qualitative research methods. The development of the qualitative aspects of the MoLeNET research approach was informed by theory and research in the areas of Action Research and Communities of Practice. These were considered to be especially relevant in view of the aims of MoLeNET which include a desire not merely to observe the impact of introducing mobile learning but to actively contribute to bringing about improvements in teaching, learning and learner experiences and to increase the number of, and skills of, practitioners involved in implementing and evaluating mobile learning.

METHOD

MoLeNET is a large and diverse programme with multiple aims and many funders who have a variety of motivations for supporting the introduction of mobile learning. This diversity necessitated the adoption of a variety of research methods to collect and analyse data at both national and local levels.

The research and evaluation strategy recognises that each of the projects have their own aims and objectives and that these vary considerably dependent upon the learners involved, the learning contexts, the subjects and level concerned, the technologies and pedagogy being employed and local priorities being addressed. All these matters were decided upon by the colleges and schools themselves with the programme only insisting that technologies involves should be handheld and pocket sized, plus necessary servers and infrastructure equipment. Therefore the Research and Evaluation strategy has at its heart practitioner-led action research projects the findings of which feed into, and help to further explain and expand the findings of, research carried out at the national level. An overview of the total strategy in 2007/08 is illustrated in Figure 1.

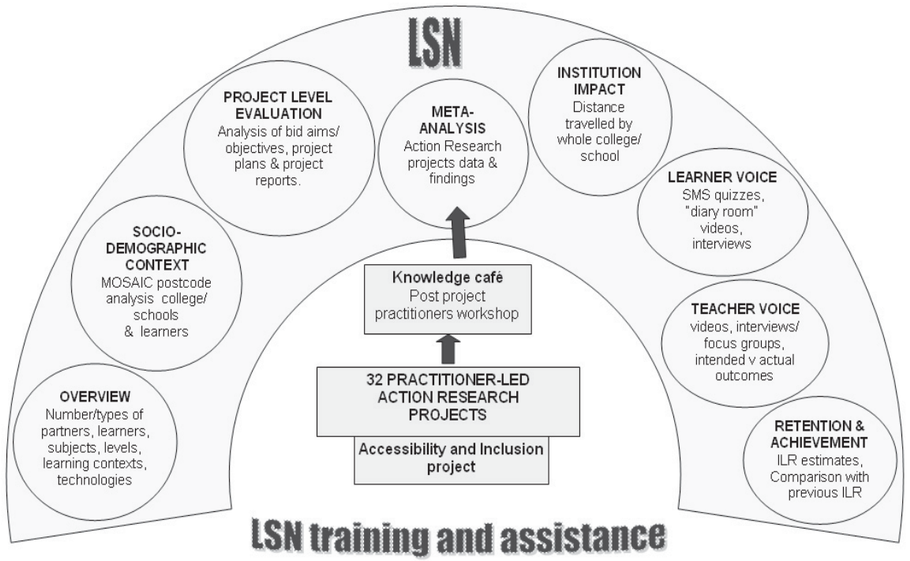

Figure 1. MoLeNET Research Overview

The programme definition of Action Research is:

“A research approach with the fundamental aim to help professionals (teachers, managers) to improve practice and to understand change processes. Using a cyclical process to diagnose issues for investigation, plan research strategies, implement, review and reflect upon findings.”

Most MoLeNET projects did not have sufficient time during a single academic year to work through more than one cycle of Action Research. However practitioner researchers were required to reflect upon their findings and to report their plans for the future building upon their findings at the end of the academic year. National research in the second year of MoLeNET includes revisiting the first year projects to find out if, and to what extent, they have continued to embed or expand mobile learning.

Each project was required to nominate a lead practitioner researcher (LPR) to lead the action research within their project and liaise with LSN researchers regarding research and evaluation. LSN researchers developed training courses for the LPRs, worked with them to refine their Action Research Plans which ensured that the research that they were carrying was out directly relevant to their projects and that the methods they proposed were practical and appropriate. LSN researchers also visited LPRs and in some cases project managers to provide further training and offer assistance and advice on data collection and analysis. A Moodle course was developed for research and evaluation materials, knowledge sharing, discussion and on-line support of practitioner researchers.

Quantitative research at national level included the collection and comparative analysis of data about the retention of learners, their achievements and also the extent and nature of their subsequent progress i.e. whether they continue with further formal learning or training or enter employment.

CONTRIBUTION

Findings relating to the effectiveness of mobile learning on the basis of outcomes data

Few research projects have collected “hard” data for large numbers of learners engaged in mobile learning. Retention and achievement quantitative research, based on a sample of 4,810 college based learners representing approximately half of all learners involved in MoleNET in 2007/08 has generated some interesting indications of the effectiveness of mobile learning from the point of view of educational institutions and their funders.

- A comparison of predicted retention data with national in-year retention rates for 2006/07 suggests an improvement in retention of 8% (see Figure 2). The total national in-year retention rate was 85.3% whilst the retention rate for MoLeNET learners was 93.3%.

  The retention rate was calculated by:

  - comparing the total number of learners that had completed their study or were continuing or intending to continue their study programme with the total records (learner completed + learner continuing/intending to continue + learner withdrawn + learner transferred to another course or provider). Due to the timescales of the data collection process, colleges were asked to submit predicted completions and therefore the rates presented for MoLeNET learners are indicative of the overall completion rates rather than actual results.

    The national comparator used was national in-year retention rates for LSC-funded Further education (FE) learners. In-year Retention rates have been based on the Individual Learner Record (ILR) 2006/07 completion data and have been calculated using the ILR field A34 Completion Status.

    The formula applied is similar to that used on the MoLeNET data collected (i.e. total number of Learners continuing/intending to continue & Learner completed records divided by the total number of Learner continuing/intending to continue and Learner completed, Learner withdrawn and Learner transfer). Only completions for LSC funded learners have been included in the national in-year rate.

  - Readers should note that the total national in-year retention rate for 2006/07 of 85.3% is slightly lower than the Benchmarking data LSC retention rate for the same year of 87.0% (Source: ILR http://www.lsc.gov.uk/providers/Data/statistics/success). The business definitions used by the LSC vary slightly to the methodology applied in this analysis (e.g. ‘Retention Rate – completers’ is the number of aims that have been completed divided by the total number of aims excluding those that were transferred and are based on mapped ILR databases). The rates are distinct as the data sources and definitions used for the calculations vary slightly therefore please note these variations when comparing the results.

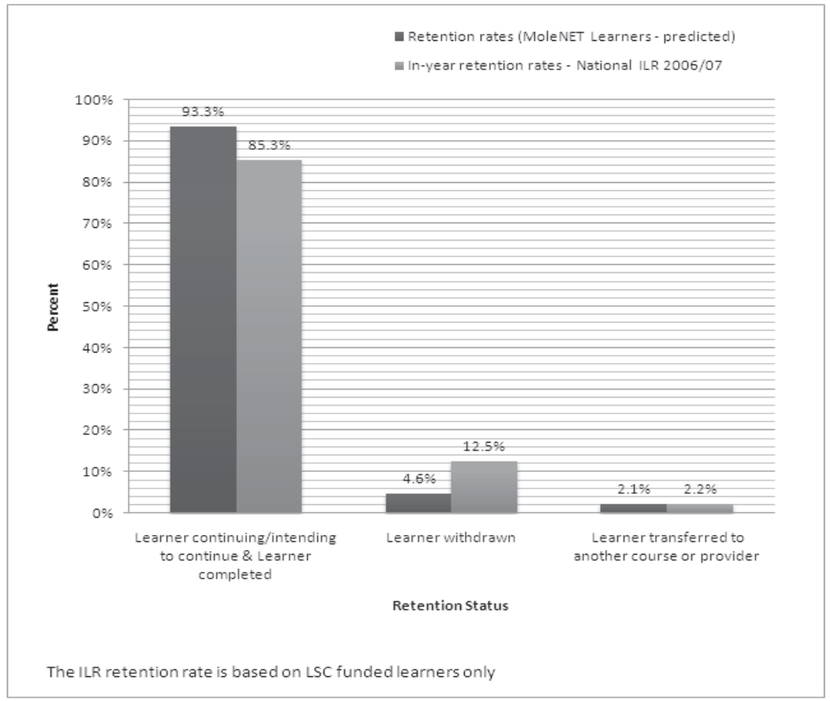

Figure 2. MoLeNET predicted retention rates compared to national in-year 2006/07

- A comparison of predicted achievement data for MoLeNET learners with national in year achievement rates for 2006/07 suggests an improvement in achievement of 9.7% (see Figure 3). The total national in-year achievement rate 71.1% whilst the achievement rate for MoLeNET learners was 80.8%.

  Achievement rates for MoLeNET learners have been calculated by:

  - comparing the total number of 'Fully achieved' records with the total number or records (i.e. Achieved + Partially + Not achieved).

    Please note that due to the timescales of the data collection process, colleges were asked to submit predicted outcomes and therefore the rates presented for MoLeNET learners are indicative of the overall outcome rather than actual results. The national comparator used was national in-year achievement rates for LSC-funded Further education (FE) learners.

    In-year Achievement rates have been based on ILR 2006/07 outcomes data and have been calculated using the ILR field A35 Learning Outcome. The formula applied is similar to that used on the MoLeNET data collected (i.e. total number of Achieved records divided by the total number of Achieved, Partial Achievement and No achievement).

    Courses with unknown learner outcomes or where exams have not yet been taken or study continues have not been included. Only outcomes for LSC funded learners have been included in the national in-year rate.

  - Readers should note that the total national in-year achievement rate of 71.1% is lower than the Benchmarking data LSC achievement rate for the same year of 88.6% (Source: ILR http://www.lsc.gov.uk/providers/Data/statistics/success).

    The business definitions used by the LSC vary slightly to the methodology applied in this analysis (e.g. Achievement Rate for known outcomes is the number of aims that have been fully achieved divided by the number of aims that have been completed and have a known outcome over the length of the learner's course and are based on mapped ILR databases). The rates are distinct as the data sources and definitions used for the calculations vary slightly therefore please note these variations when comparing the results.

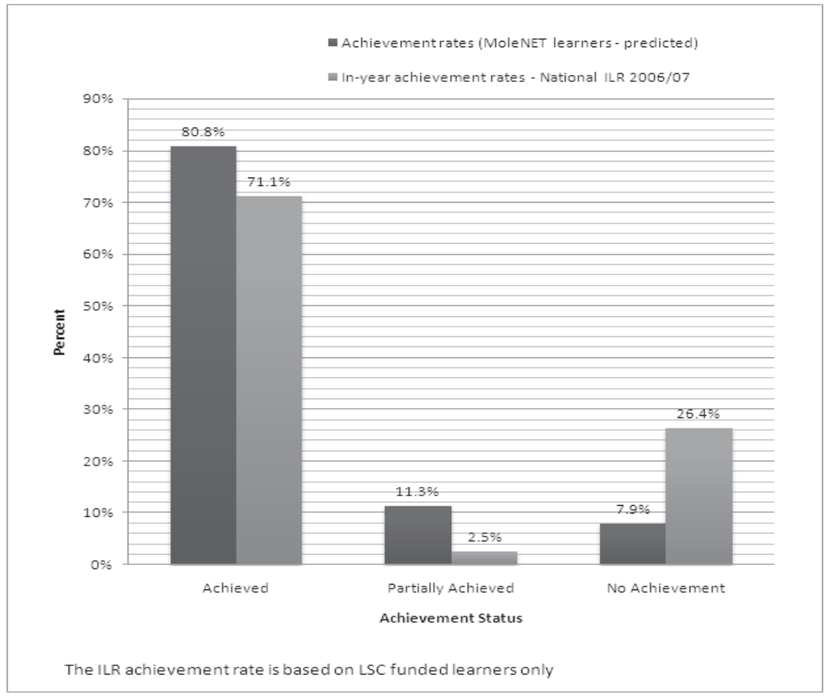

Figure 3. Predicted MoLeNET achievement rates compared with national in-year rates for 2006/07

In considering the above information concerning retention and achievement rates it is important to bear in mind the following:

- The MoLeNET figures are based on predicted not actual ILR data
- It has not been possible to control for factors other than the introduction of mobile learning which could have impacted on retention and achievement
- Some practitioner researchers and project managers reported retention and achievement improvement strategies running in parallel with MoLeNET
- Initiatives which involve re-thinking delivery, and particularly those which involve special attention to the personalised learning needs of specific groups of learners, are likely to lead to improvements in retention and achievement whether or not these involve new technologies

However, qualitative data collected by practitioner researchers via teacher interviews, questionnaires and focus groups provides some support for the suggestion that improvements in retention and achievement have resulted from the use of mobile technologies. More information about this research is due to be published in the near future. Some teachers have reported observing improved retention and achievement which they believe to be a direct result of the introduction of mobile learning.

This data, and more qualitative data collected via lesson observations and by teachers and learners responding to LSN's SMS surveys, suggests that mobile learning has improved the quality of teaching, resulted in better learner engagement and improved attendance. All of these effects are believed to impact positively upon retention and achievement.

- Progression is an indicator of a positive life chance outcome for learners, i.e. progression to another learning opportunity or to employment which may include work based learning opportunities.

  89% of the MoLeNET learners for whom progression data was received were reported to be progressing to further learning or employment. The two main progression routes for learners in the sample were to continue to further education or continuing in their existing programme, followed by progression into employment (including both employment and apprenticeships). A few learners progressed on to higher education.

Findings related to improving teaching and learning

The findings of MoLeNET research provide insights into many different areas including: learner engagement, learner enjoyment and satisfaction, learner self-confidence and self-esteem, personalisation of learning, support of work-based learners, support of learners with learning difficulties or disabilities, teacher/learner communication, collaborative learning, etc. In this paper only those findings related to improving teaching and learning are discussed.

Some key findings from the 2007/08 action research projects related to improving the quality of teaching and learning are:

- It is very clear that mobile devices can and do support and encourage learning at any time of day, at any location including in college or school, at home, in the workplace, on field trips and in transit. Learning is more convenient, more accessible and more sensitive to the learners' needs and lives.
- Mobile technologies enable technological support for learning in the normal learning location (which could be a classroom) in contrast to the previous experience of learners having to go elsewhere to use computers.
- Mobile technologies enable learners to maintain synchronous and/or asynchronous supportive dialogue with staff regardless of their location
- Mobile technologies are able to encourage and support both independent and collaborative learning.
- Preparation undertaken prior to introducing mobile technologies into lessons is important and a differentiated approach tailored to needs of specific learners and their context rather than a one-size-fits-all strategy will maximise the benefits of mobile learning.
- The advantages of mobile learning are not fully realised if existing materials are simply converted to a format to go onto a mobile device. Starting from the lesson objective and establishing how mobile learning will enhance the delivery is recommended.
- Production of learning materials for use on mobile devices can be time consuming and a steep learning curve is involved.
- Training and support for staff is critical and the full benefits are likely to emerge over a timescale longer than one academic year.
- Incorporating formative assessment into mobile learning improves it's effectiveness and many learners enjoy using mobile technologies for formative assessment
- Mobile technologies have enormous potential for summative assessment. Generally tutors, assessors and learners have expressed a very positive reaction regarding the ability of mobile devices to support assessment processes and projects have trialed a variety of new techniques. However, staff development is required and it is necessary to ensure that examining bodies are willing to accept evidence collected in this way.

More than half of the MoLeNET projects used mobile technologies for work-based learning and the reactions of learners, assessors and employers were mostly very positive. Although an important lesson learned was to ensure the full understanding and agreement of employers prior to introducing the mobile technologies on their premises.

Some key findings were:

- For work based learners or those on work placements access to a computer and/or the Internet is often limited, if available at all. Therefore a significant advantage of mobile devices is that they can enable learners to access learning resources and support, to continue to work on their coursework and assignments and to keep in touch with staff and peers whilst on placement.
- The size of the handheld technologies and, in some cases the long battery life, has enabled them to be used in workplaces, such as factories, riding centres and horticultural centres, where it has not previously been possible to use technology.
- In some cases work based learners have completed and submitted coursework earlier and to a higher standard.

Six projects aimed to utilise mobile technologies to change and improve the way that learners with learning difficulties and disabilities (LLDD learners) learn. Four projects stated that they were able to achieve these aims.

Aylesbury, Gloucestershire and Eccles aimed to improve employability for LLDD learners within their projects. Eccles and Aylesbury report improvements in life skills, independent living skills and citizenship; and National Star College (Gloucestershire consortium) reports improved achievement led to learners gaining both paid and voluntary employment.

Aylesbury, Stockport, Worcester and Lowestoft all aimed to reduce barriers to learning and thus increase accessibility for LLDD learners. Aylesbury report that learners now have access to more ICT equipment, which has started to transform the way they learn. Aylesbury also report a predicted 50% increase in recruitment for their 2008/2009 skills for working life course. At Stockport, some barriers to learning have been overcome by the introduction of alternative methods for learning through mobile devices, such as using images instead of written instructions. Learners at Lowestoft used mobile devices to evidence tasks they had completed and Worcester investigated the use of podcasts and vodcasts for visually impaired learners.

EVALUATION

The success of MoLeNET seems to be partly a result of the timing of the programme. When MoLeNET was being planned two it became clear that the programme's initial success was dependent upon two critical factors i.e.

- "The programme is dependent upon the willingness of colleges to accept a funding model which requires them to contribute to project funding at 20% of the value of the capital funding they receive and this will be a condition of receiving capital funding"; and
- "We are assuming that there will be sufficient interest in mobile learning to attract the required amounts of project bids."

In practice the new funding model was very readily accepted by a large number of colleges. The programme team contributed to this success by collaborating with LSC to develop the model and by devoting considerable effort to publicising and explaining the model, its implications and the way in which it would be implemented.

However the model would have been of little help if the colleges and schools who proposed MoLeNET projects had not believed that mobile learning would bring benefits for their learners and their institutions. This belief seems to have resulted from an interest in the potential of mobile learning, particularly to assist in engaging or supporting particular groups of learners who have been difficult to support using only traditional tools. This interest in mobile learning was found to be substantial. The programme team contributed to this by:

- engaging the sector in and publicising the previous LSN/LSC mobile learning research and development work
- publicising MoLeNET and organising an Information Day and a Launch Conference to provide generic information and examples of mobile learning research and practice as well as providing specific information about MoLeNET.

The quantitative research involving collection and comparative analysis of data concerning the retention and achievement of a large sample of learners has been extremely helpful in demonstrating to funding authorities and institutions management that mobile learning is not merely a gimmick but rather a pedagogically valuable way of applying technology to assist teaching and learning.

The use of action research to encourage, support and measure change and improvement facilitated by mobile technologies has involved a great deal of hard work for the practitioner researchers involved. In some cases institutions have expressed reservations about the amount of work involved and the cost in terms of staff time. However in many cases researchers have, when reflecting on their experiences and findings, expressed recognition of the value of the action research approach. Some have also commented that their involvement in the project and the training and support received has been a valuable learning experience.

CONCLUSION

The timing of the introduction of MoLeNET was very good. In the UK, after many years of mobile learning being a fairly small and specialised area of research interest, changing attitudes and successful dissemination of information from previous projects created an atmosphere in which a large number of colleges were interested in trying mobile learning for themselves. Evolving, stabilising and, to some extent, greater standardisation of mobile technologies and the increasing ubiquity of wireless networks also helped. The combination of these factors meant that MoLeNET was initiated just in time to catch the zeitgeist.

MoLeNET research has contributed, and in the second year will contribute further, to a body of emerging evidence of the contribution mobile learning can make to improve the quality, convenience and outcomes of teaching and learning.

MoLeNET's quantitative findings are especially persuasive to the funders and managers of education who it is necessary to persuade in order to secure future funding for mobile learning. One reason for this is that these findings are based on data from significant numbers of learners.

MoLeNET Action Research has helped to ensure that the aims and objectives of the MoLeNET projects have been addressed and their impact and outcomes assessed locally in a way which is informing participating institutions on-going e-learning and improvement strategies. It has also contributed to capacity building in the FE sector for both mobile learning and research expertise and contributed to overall findings about the ways in which handheld technologies can enhance, support and extend the reach of education and training.

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Online Mobile Communities to Facilitate Social Inclusion of Young Marginalised People

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BACKGROUND
Young people are assets to development and potential agents of social change. Yet, youth exclusion is widespread and globally increasing. As various studies suggest marginalised young people also have only random access to Information and Communication Technologies (ICT) such as the Internet. However, the access to mobile phones does not differ from their peers'. Taking this fact into account, reaching out to marginalised young people and finding a way to re-integrate them into society through their mobile phones seems a promising approach. The main objective of our project is to study and utilise mobile networks and telephones that are most commonly used by marginalised youth, as the main infrastructure for social inclusion. Using innovative real-time integrated communication video solutions, this project will develop a networked media platform that will give rise to mobile online communities, delivering interactive media content specifically aimed at marginalised youth.

METHODS
Our project follows a user centred design approach that requires involving the target group from the very beginning of the technological development in order to study its needs and characteristics that will then be reflected in the design process. Firstly, through academic literature review, expert interviews and focus groups with marginalised young people, determinants and factors leading to marginalisation as well as their access to and use of ICTs are studied in detail. Secondly, an exploratory research of mobile communities aims to study its success factors. The content design, the user interface and user modelling lastly takes all the gathered requirements in respect to our target group into account.

CONTRIBUTION
As our project is still ongoing we will be able to present the status quo as well as future steps in our research. Recent findings comprise the user requirements that will serve as basis for the technological developments.

EVALUATION
The project will also evaluate the online mobile communities' tools and services as well as the technical infrastructure and user interface. It will design and run two different pilots focused on two populations and will collect quantitative data that will support the feedback input that may eventually lead to a redesign of the prototype.

REFLECTION
The research accomplished so far indicates that little is known about the requirements of marginalised young people in regard to access to and use of ICTs. Also, statistical monitoring of the prevalence of marginalised young people and figures of penetration rates of technologies such as the mobile phone are not available in regard to this target group.

These initial findings as well as future results and outcomes of the project will be used to formulate recommendations and an outline for a future research agenda.

mLessons

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ABSTRACT
This paper focuses on the application of mobile technologies to develop students' higher order thinking and learning. It continues the story of the application of a Pocket PC program at Highvale Secondary College, a State Government school in Melbourne, Australia.

One of my challenges as principal of a well established, traditional secondary school of 800 students was to improve teaching and learning outcomes through changing the existing teaching methodologies. To this end I developed a Pocket PC program. Similar to a laptop program, each student has their own Pocket PC to use to improve their learning. The school is in its third year of the program, and has two classes of Year 7 (13 year old) students and three classes of Year 8 (14 years old) students involved. Parents opted into the program by contributing some US$280. Our students take their devices to all lessons and are instructed by their class teachers in the applications for that lesson. A regular mlearning newsletter is provided by the school to inform parents and students of developments, issues and technical points. This has been very well received.

In developing this program, I was keen that this learning tool would be put to greater use than simply accessing the internet or Microsoft Office applications. To this end, specific software was developed that integrated with the school's teaching and learning model. This software, called mLessons, offers students a suite of thinking curricula tools. These mLessons enable the student to think critically about their learning process. They include applications of De Bonos thinking hats, a range of graphic organisers, tests for multiple intelligences, thinker's keys and SMART goals. These mLessons are used in class across all learning areas by students to critically reflect and plan out their steps for learning. Students select a particular mLesson application to complete before they tackle the classroom learning task. The mLesson enables the student to identify their learning goals, plan how they will achieve them and afterwards, reflect on how well they have learnt. Students can compare their learning goals and learning strategies with other students. Teachers can use the student mLessons to modify, encourage and motivate students to extend their learning experience.

The mLessons have enabled students to take more responsibility for their own learning. It has changed the way lessons are presented, from teacher directed (and giver of all knowledge) to student initiated research and more collaborative learning situations. The Pocket PC program and mLessons have trail blazed the teaching and learning focus of the school and encouraged its successful adoption into mainstream classes.

It is our intention to extend this program across the school in later years and will be a distinguishing feature of Highvale Secondary College.

QR Codes, Cell Phones and a Graphic Design Scavenger Hunt

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ABSTRACT
Graphic Design students used cell phones to engage in collaborative, exploratory research through the use of QR Codes and various social media tools (Flickr, Google maps). Although this project used inquiry-based learning with mobile devices to map and critique images of local signage, the general project structure could be modified to suit almost any discipline.

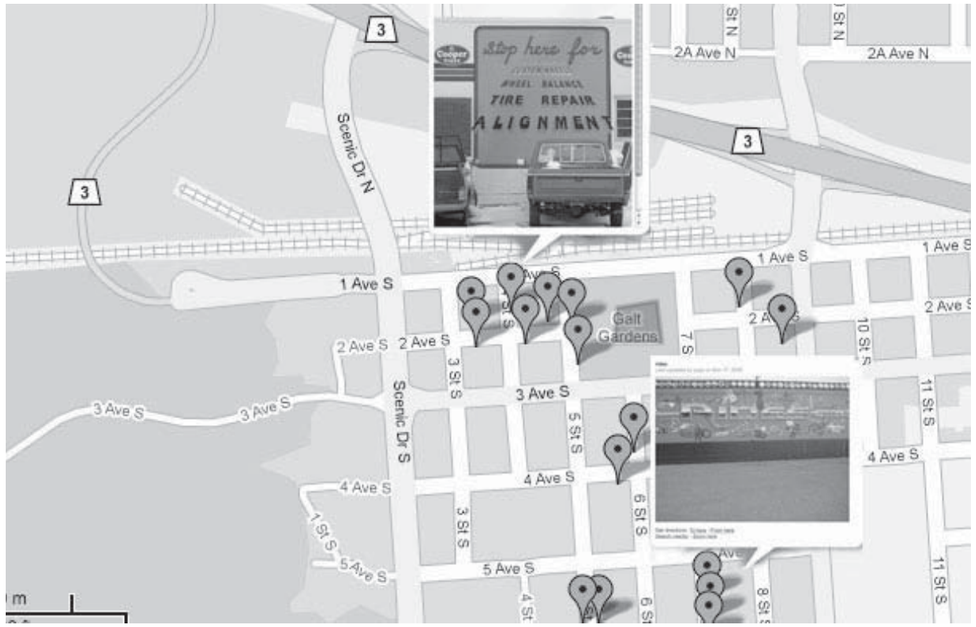
Author Keywords
QR Codes, Graphic Design, web 2.0

QR (Quick Response) codes are digitally-created codes that store small amounts of data and can be read with a cellphone camera. The data can include text messages, a hyperlink to a web page, video or numeric data such as phone numbers. While the use of QR Codes in Japan and Europe is common, they have not been embraced by North America quite as quickly.

Student teams were sent on a *Signage Scavenger Hunt* to learn about typography and design used in local commercial signage. They were given multiple QR Codes that, once read with their cell phone cameras, gave various forms of pre-programmed information about where to find the next sign. Some codes contained texts that would be sent to the user's phone, others contained URL's that had clues, and a few took the user to YouTube where a video would play out, describing the next location of signage.

As the teams of students found the locations, they would photograph the sign, send the image to their Flickr account, and then map the image, as well as any information they wanted to provide, to a specific location on Google Maps. By the end of the scavenger hunt, a precise inventory of signage from around the downtown core of the city emerged.

Initially, teams were used instead of having students work independently because not all students had smart phones that would be able to read the QR codes. It became apparent as the project progressed that the sharing and collaboration that the team model allowed was one of the strongest aspects of the endeavour. Teams also became competitive, vying to upload more images or solve the clues faster.



While the scavenger hunt was an interesting way to introduce students to a new way of using their cell phones and to have them explore local signage and advertising, the real value of the endeavour came afterward, when students photographed and posted long after the project was introduced. One of the goals of constructivist learning is to foster the development of shared meaning (Novak, 1998) between facilitator and learner or between learners in a group, and this was demonstrated many times when a new image or video would appear on our class map (through Google maps), and the student would proudly draw our attention to it. The design of the sign would be critiqued in a classroom meeting, which would in turn motivate other students to search out and photograph more work, which generated more in-class discussion. Students developed an ownership of the map that was emerging, and were excited to share it with friends and family. A general awareness of how learning can be extended beyond the classroom emerged and students became quite engaged in generating ideas of how using their phones could build on what was being discussed in class.

Evaluation and Reflection

The *ownership* of knowledge that students can gain from exploring and collaborating on their own is invaluable. Mobile technology allows learners to extend the ideas generated in a classroom setting into 24/7 awareness. Moreover, the reciprocal teaching that students engaged in with both the instructor and each other reinforces their knowledge. Discussions in class revolved around the discovery of a new sign, the selection of typeface on a particular sign or the ways that signage could be improved. Several more projects that use this basic ‘game’ model of a Scavenger Hunt to introduce concepts to Design students will be introduced over the next term.

Mobile Game-Based Learning: Best Practice Modules for Online Teaching

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INTRODUCTION

This paper will focus on the design and delivery of seven Mobile Game-Based Learning (MGBL) modules on the best practices for a series of online teaching topics: real-time chat, discussion forum, presenting contents online, online course communication, managing online assignments, designing online learning games, and online testing. New online faculty members will access these MGBL modules and take the assessments via the ANGEL Learning System. Upon satisfactory completion, they will get their first online teaching assignment. The MGBL modules may be displayed in multiple gaming formats: Jeopardy-like, Challenge, Squares, and Clue games, playable via Flash-enabled mobile devices. It is the intention of the presenters to model for the new online faculty the paradigm shift to using mobile game-based learning pedagogy in the online curriculum design.

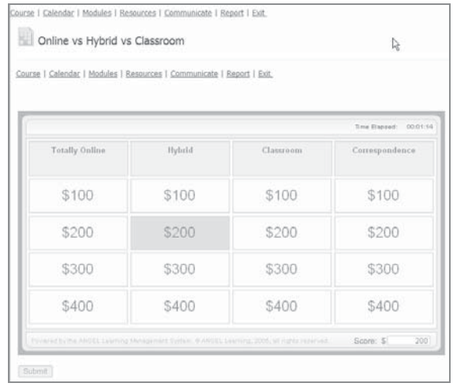

Figure 1. A Learning Game in the ANGEL Learning System

7 BEST PRACTICE MODULES

1. **Real-time Chat**. The best practice strategies to be addressed are in the areas of strong instructor presence, timing and time zone issues, chat size, chat protocol, chat preparation, chat grading, and chat technical issues. This area may create the most technical issues for both instructor and students. The game formats for this feature are the Challenge and Jeopardy-like games.

2. **Discussion Forum**. The best practice strategies covered in this area include the art of designing discussion questions, student motivation, topic relevance, organization of discussion topics, order and netiquette in the online discussion environment, grading of discussion threads, and instructor presence. The game format for this feature is the Jeopardy-like game.

3. **Presentation Contents**. The best practice strategies of this feature include information chunking, interface and navigation design, fonts and graphics, color and contrast, and multiple learning modalities. The evaluation and quality assurance of content congruency need be built into the design right from the beginning so that quality control staff may conduct their work productively. The game format for presentation contents is the Clue game.

4. **Online Communications**. The best practice strategies are in the following areas: response time, timely feedback, regular notices and reminders, communication consistency, and the student “venting” forum (i.e. student lounge). The game formats are the Action Challenge and Jeopardy-like games.

5. **Online Assignments Management**. The best practice strategies for this feature are clear directions, organization of assignments, synchronization with the course calendar, file formats, grading, and feedback. The game formats for this feature are the Squares and Jeopardy-like games.

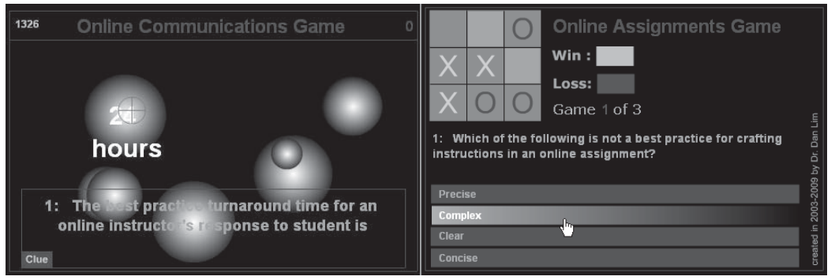

Figure 2. An Flash-based Action Challenge Game and Squares Game

6. **Online Learning Games**. The best practices are based on the 10 guiding principles of game-based pedagogy covered by the presenter at another conference: Intellectual engagement, maintaining attention span, compelling feedback, learning from mistakes, mitigating difficult contents, learning during leisure, accommodating learning preferences, intuitive environment, enhancing retention, and fostering team building. The game format for this feature is the Squares game.

7. **Online Testing**. The best practice strategies are dealing with issues faced by faculty revolving around assessment integrity, security, batch uploading of questions, student electronic testing anxiety, question formats, test banks, adjustment of scores and answers, and technical emergency. Given the list of concerns, online testing is an area where most faculty would need a lot of training, help, and timely support. The game formats for this feature are the Jeopardy-like and Challenge games.

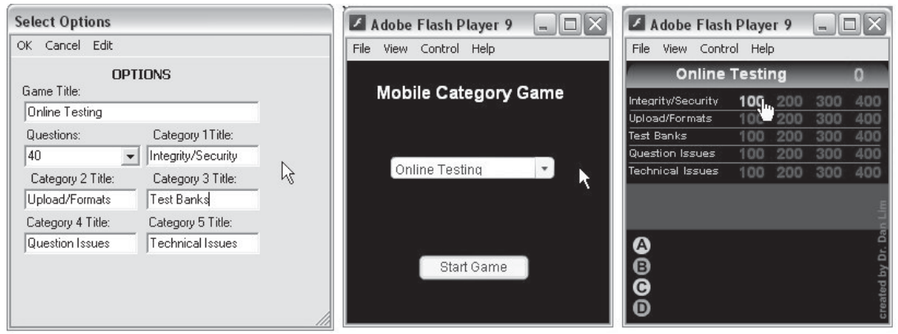

Figure 3. A Flash game generator and player on a Flash-enabled mobile device

Understanding the Value of Mobility and Movement in Learning

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ABSTRACT
The paper reviews current understandings of mobility in relation to learning, noting that relatively little attention has been paid to how travel, and movement/displacement more generally, can affect readiness to learn. The methodology includes a 'values review' (to ascertain the value of mobility) in the form of a literature survey and a 'discipline review' seeking to broaden the perspective by identifying contributing disciplines. Outcomes include appraisal of evidence that movement and travel can have an impact on 'state of mind'; an analysis of values ascribed to learning on the move; and a visual representation of disciplinary concerns and findings. Implications for m-learning research, design and practice are considered.

Author Keywords
Mobility, movement, educational values, contextual learning, state of mind, interdisciplinarity

As researchers in the field of mobile and contextual learning progress toward deeper community reflection on what has been achieved and where we are heading, this paper takes stock of our current understandings of mobility in relation to learning. Previous related work has considered mobility from philosophical, educational and pragmatic perspectives, often emphasizing continuity of learning across contexts, and enhanced collaboration which comes from freeing learners from the constraints of physical space and fixed computers. Relatively little attention has been paid to how travel, and movement/displacement more generally, can affect readiness to learn, and the significance of 'place' and direct experience in relation to learning. Some recent analyses of mobile learning focus on its 'site-specific' nature. Literal interpretations of 'site' as a physical space have been expanded to include more abstract interpretations, yet there is still a need to describe the contribution of physical experience.

The research presented in this paper aims, on the one hand, to review how researchers and practitioners are assessing and presenting the value of mobility when they report on the ambitions and conclusions of their studies; and on the other, to consider the full range of disciplines and sources that can provide us with perspectives and research findings on mobility in relation to learning. The initial starting point was an analysis of terminology related to mobility, encompassing travel and movement (real and virtual). The 'values review' takes the form of a literature survey based on publications from key conferences (such as mLearn) and journals, including several recent special issues dedicated to mobile, ubiquitous and contextual learning. The 'discipline review' seeks to broaden the perspective by identifying disciplines that have something to say on the matter of mobility and learning, including education, psychology, geography, philosophy, human-computer interaction, linguistics and literature; their contributions are noted and interrelationships are established where relevant.

One outcome of this research is evidence in support of a hypothesis that movement and travel can have an impact on 'state of mind'; currently this aspect is underrepresented in mobile learning research and practice. Another outcome is the analysis of values ascribed to learning on the move individually or with others. A third outcome is a visual representation of disciplinary concerns and findings. This representation can act as a focal point for discussions among researchers and practitioners; it is also seen as a potentially helpful reference point for new projects and initiatives needing to clarify their objectives or evaluate learning gains.

As with any research that tries to combine breadth of inquiry with depth of understanding, the scope of this research is a challenge. Nevertheless mobile learning is recognized as an interdisciplinary pursuit, and revisiting the possible contribution of various disciplines is a worthwhile undertaking. A better understanding of those contributions will require collaboration among domain experts. Often research and development projects have no time to undertake this kind of fundamental enquiry, but it is hoped that this research will inform the design of future projects and selection of research partners with relevant expertise.

Process and Problems of Developing a Cell Phone Delivered College Course

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ABSTRACT
This short paper will explain the processes being used to develop an online college credit course for delivery via cellphones. While the course is still in the process of being developed for delivery in Summer of 2010, the paper will address course modification requirements, ion of Web 2.0 applications, cellphone specification requirements, and application of the "Quality Matters" distributed learning review rubric to a course modified for delivery via the cell phone.

Author Keywords
Mobile, phone, cell, cell phone, Dakota State University, online, college courses, mlearn, mlearning, smartphones

INTRODUCTION
The evolution of the cell phone from a high priced luxury to an everyday ubiquitous device has been extraordinarily rapid. As it continues to evolve, with next generation devices like the iPhone and their contemporary mobile counterparts, many of the applications once thought of as the realm of the personal computer are becoming (or have become) available on the mobile phone.

Persons can text and use voice for inputs, download and share files, and publish to web based Web 2.0 applications. In short, it has many of the abilities of a computer. After having some success with using the cellphone as a learning device in a charter school for highly at-risk students, this author is looking to extend those capabilities into a college course.

METHODS
The process of preparing a course for delivery via cell phone is three-fold. 1st, the content of the course must be modified to be easily consumed via a cellphone. For the course in Human Growth, this has meant a move away from a textbook based course, and a move toward web based resources. It has also resulted in breaking up the evaluation cycles, from 5 fairly long quizzes to 10 shorter, weekly ones. The 2nd point of use is identifying which Web 2.0 applications are viable for use. This can be somewhat fluid, particularly in our turbulent economic times, which is witness to an almost daily creation, destruction, and modification of Web 2.0 apps available. Current applications/Websites being considered are: Google SMS, Gabcast, Flickr, VoiceThread, Phonevite, DailyBooth, Rocketron, Dial2Do, Jott, Tinypaste, Yodio, PollEverywhere, Drop.io, DailyLit, BookGlutton and BooksInMyPhone. The 3rd area of consideration is platform delivery. iPhone is virtually absent from South Dakota, as the low population base makes it difficult for AT&T to put up transmitters.

CONTRIBUTION
The project is ongoing. We identified the following thematic areas:

- GUIDELINES – In the context of online course delivery at Dakota State University, online guidelines are defined through the "Quality Matters" process. This is a series of checkpoints that a course has to meet to be certified as a well developed online course.
- TECHNOLOGICAL ELEMENTS – Our course delivery system is Desire2Learn. It is uncertain at this point how much we will be able to use that system with cell phones to achieve desired outcomes. The Web 2.0 apps listed above offer enticing possibilities, but lack the convenience of centralized course management.
- EDUCATIONAL PRODUCT – The educational product is the course, Human Growth and Development. The course must be delivered with no long term loss of quality, though it is expected that there will be "bumps in the road," as there are with any new technology.
- LEARNING PROCESS – The learning activities are balanced between selected readings and carefully defined Web 2.0 cell phone capable activities.
- EVALUATION - Standard course evaluation tools will be used.

REFLECTION
When successful, using cellphones for delivery of online content should open up educational opportunities for many.

Mobile Delivery – Towards Portable Cloud Computing

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ABSTRACT
How do you migrate up to 16,000 students (almost all fully employed) to mobile delivery of various course elements? Thomas Edison State College in Trenton, NJ is rolling out their mobile learning initiative in July 2009. Using Hot Lava Software, they converted content for delivery to any Web-enabled cell phone, trained all staff to coach and mentor students in mobile delivery and built enthusiasm for meeting student needs to learn "anywhere/anytime."

Author Keywords
Cloud computing, conversion from eLearning, mobile platform

BACKGROUND
What do you do when you have a student population taking online programs, but their Internet connectivity is problematic, yet they express the need for cloud networking to be able to access their course content and their coursework anywhere, any time? Enter mobile delivery of course content and more.

Conceptually, mobile learning is easy for the 20 something student population. But at Thomas Edison State College (TESC) the average student age is 34 and many students over 25 seldom use a cell phone for anything other than to place a voice call, or perhaps send a text message. Many are also deployed military with significant wireless and Internet restrictions.

All TESC's students interact with the college at a distance for all the services they require; 16,000 students, most using desktop delivery of courses. The challenge is how to get from PC familiarity to "palm of the hand" delivery of course information, quizzes and test prep. The average TESC student is working full time and needs to fit academic work in wherever and whenever possible. Mobile learning is regarded as one of the most appropriate platforms to help meet those student needs.

METHODS AND CONTRIBUTION
TESC selected Hot Lava Software as the mobile platform that would best meet the varied needs of their students. Conversion of course elements was done by TESC staff.

Beginning in July 2009, TESC will deliver selected materials for students enrolled in ten courses. TESC began in the Spring by training College staff to use and understand mobile delivery thoroughly so they could coach and mentor the students with whom they have frequent contact. All Web-enabled cell phones will be welcome, so no student will feel left out because they did not purchase an expensive Blackberry or iPhone.

REFLECTIONS
As this project only commenced in July, 2009, our reflections will be newly presented at the conference. There, we will discuss all aspects of the TESC role out – the successes, "do-overs" and "never do agains.". We will also discuss our progress on conversion of full courses for mobile delivery, not just course elements.

Creating Mobile Learning and Performance Aids for the Next Generation of Learners

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ABSTRACT
Captivating the attention of today's learners is a well-known struggle within the simulation, training, and education industries. Current and future generations learn differently than previous generations. By delivering products and researching best practices to deliver content on mobile platforms, the presenter will discuss successful implementations and lessons learned from the Military, Government and Academic sector. Additionally, the presenter will discuss the latest technological advances in mobile performance support tools, examples of language and culture portable education, Sign language education, and how the medical community is looking at leveraging these devices for high fidelity treatment/patient simulation.

Author Keywords
Government, military, academia, public, healthcare, medical, iPod, mobile technology, performance support, language, culture, portable training

INTRODUCTION
How do we engage and create learning and performance support aids for our Military? We need to create potentially "game-like" blended learning initiatives (live, virtual and constructive) from recruitment to retirement. This product should be able to be useful from the start of basic training but also be useful to a more seasoned veteran.

MOBILE PERFORMANCE SUPPORT
An example of successful product implementation in the Military space is Vcommunicator® Mobile LC, the first wearable iPod based Language and Culture Mission aid for Afghan Dari and Pashto, Modern Standard Arabic, Iraqi Arabic and Kurdish. This device provides mission-specific phrases, as well as vocabulary, and gestures for each language and region. Images of maps, individuals of interest, and favorite phrases may be added and modified in the field. The system is used for both learning and "just-in-time" reference. Vcommunicator Mobile LC is currently deployed with troops in Afghanistan, Iraq, and Sudan.

When developing this product many questions arose. How do we provide the full impact of culturally appropriate knowledge in limited time? How do we create learning that is accessible anywhere? How do we take the high fidelity training received in the classroom to the user on the battlefield? Several factors including the limited amount of training time and the magnitude of skills needed to deploy anywhere in the world at a moment's notice make these questions critical. The answer to these questions was to leverage technology and devices already on the market.

Commercial-off-the-shelf (COTS) ,devices already familiar to warfighters, fills the gaps found when extensive training is unavailable. We take the power of these portable devices and provide learning on the front line to ensure accessibility and competency. For example, Job Performance Support takes on a sense of urgency when responding to a Chemical, Biological, Radiological, Nuclear, or Explosive (CBRNE) threat or a medical emergency associated with the catastrophic results of an Improvised Explosive Device (IED). Advances in portable devices and application software have resulted in vast amounts of time-sensitive information being readily available at one's fingertips anytime and anywhere. Imagine being able to perform a 3D fully interactive Crichothyroidotomy from a device carried on your hip. That is revolutionary and that is how the next generation will learn.

Challenges and Solutions of Mobile Learning in the Enterprise Architecture

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BACKGROUND
This paper takes a practical look at specific issues related to mobile learning within the enterprise. It compares learning versus mobile learning. Without a doubt, today's workforce has different trends due to the proliferation of mobile devices, and certainly this change the way mobile workforce learns. Although there are many mobile communication architectures, mainly focused for consumer markets, enterprise has unique requirements that prove to be a challenge in creating an effective enterprise mobile learning solution.

METHODS
In this paper we discuss a specific method that leverages current enterprise communications infrastructure to create an effective mobile learning solution for the whole company. This method utilizes software modules to connect many Learning Management Systems throughout the enterprise to many types of mobile devices utilizing a single course type and current enterprise communications infrastructure.

CONTRIBUTION
The author has done several pilots for the last four years with Fortune 1000 companies utilizing vLearning software to test and demonstrate the method described earlier.

EVALUATION
The pilots' results are encouraging since they proved the method to be effective as a true enterprise mobile learning solution. The pilots demonstrated the technical solution having a great acceptance among the companies that participated and having lower overall cost than current solutions. The author not only proved that the method is successful in accomplishing an effective enterprise mobile learning solution, but it also opened up the discussions of new ideas that are being explored for future pilots, such as peer-to-peer mobile learning.

REFLECTION
As explained in the Evaluation section, the method used in the pilots showed that an effective enterprise mobile learning solution could be created within the enterprise firewall, without adding new networks to the communication architecture. This showed to be a significant cost reduction in adding mobile learning solution to the company. Also, this method showed an effective way to leverage the Learning Management Systems the company already has, even when they were not designed to be for mobile learning. The method added functionality to the company by giving metrics reporting capabilities for mobile learning even when no connection is available to the device. We also discovered that there are different types of mobile applications even if the end user is not travelling. The end user surveys indicated that they prefer mobile learning at the "point-of-action" over having to go to a classroom. Many of the end users prefer the "informal and personal" learning they receive with mobile devices. This method has the elements to be a game changer in the mobile learning industry.

Mobile Learning for Deployed Military Students

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ABSTRACT
Underserved military students may become some of the early adopters of mobile learning as more portable and handheld devices are implemented for accessible education that meets their unique situations. Florida State College is one of the largest education providers of service men and women, harnessing effective technologies and practices to provide accessible and innovative learning solutions. This paper is an overview of one such development project, documenting the design of 6 entirely mobile courses for the United States Army.

Author Keywords
Mobile learning, offline, distance learning, military

BACKGROUND
In 2007-2008 the United States Army Headquarters Continuing Education System partnered with Florida State College Jacksonville to develop college courses for delivery using a mobile, offline distance-learning model. The yearlong contract sought to preserve equivalent curricular standards and learning experiences while specifically addressing the nature and challenges of a disbursed, disconnected student population. This paper will highlight the course design background, future, directions, and implications for research.

Following the tenants of the contract, Florida State College formed course design teams to produce six fully mobile college courses. They were to be context-independent, not restricted by traditional college term lengths, and free from the necessity to be constantly connected to the internet and a traditional learning management system. College faculty collaborated with the instructional design teams throughout the development phases, which also included faculty producing various instructional media that were then sequenced and incorporated into the final course materials. Faculty participated in an extensive customized mobile learning and design training program. Their training resulted in the faculty learning how to communicate better with new media such as podcasts and simple learning objects.

The target audience was junior to mid-career soldiers continuing their professional development and personal education. The selected courses mapped to career and education degree plans for various enlisted career fields. The population-specific content was included in the courses as a course augmentation that was intended to provide advising and student services information.

METHOD
Motivation was considered to be a potential limitation for this population due to their deployment, potential isolation, and delayed learning interactions with other learners and their instructor. To compensate, the instructional design attempted to foster learning experiences around the individual student's unique environment and contexts by building in opportunities for situated learning activities (Lave & Wenger, 1991; Brown, Collins, & Duguid, 1989) and individualized assignments.

Various handheld devices were evaluated against criteria tailored to the contract requirements and population needs. Two net-book style devices were selected to design the courses on, the Pepper Pad 3 and the Tablet Kiosk eoV711.

REFLECTION
Two pilots are projected as a result of this project. These pilots are due to be developed and delivered with both military and non-military students in 2009-2010. In the fall of 2009 non-military students at Florida State College will participate in an eReader pilot program where all of their course materials will be delivered on a mobile eReader device or, potentially, across multiple devices. Additionally, beginning in September of 2009, Florida State College will design 8 more mobilized courses using net-book devices for the United States Navy. What is still unclear at this point are how actual students experience these types of mobile courses. Studies that focus on student experiences, specifically in-depth case studies, may begin to uncover data that could help guide and improve design and future mobile learning offerings.

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Co-Designing Mobile Collaborative and Tangible Math Activities

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ABSTRACT
In this paper we present the design challenges that mobile technologies raise for supporting collaboration across different locations using mobile devices and PCs for middle schools in the field of mathematics. Learning geometry presents interesting opportunities for integrating traditional and digital learning tools (manipulatives) that bring together mobile, web, and 3D tools. We want to promote and enhance collaboration by enabling learners to engage in mathematical activities across diverse settings inside and outside the classroom. Our goal is to design and implement meaningful learning tasks supported by mobile and ubiquitous technologies that help students collaborative explore, learn and visualize math together with teachers.

Our view of learning adopts a social constructivist perspective, since we are primarily concerned with supporting and enhancing collaboration between learners with the support of mobile technologies by emphasizing on the negotiation of meaning and on the processes of joint construction of understanding. The methods employed for the design of these activities are based on a participatory design perspective. Three math teachers from different local middle schools have been actively involved throughout the entire design process and they play key roles in order to promote educational innovation. Activities in the design process include structured brainstorms and teamwork that aims at developing learning tasks that are part of the school curriculum. Geometry Mobile (GeM) is part of 3-years ongoing project that explores how teachers can develop and implement novel educational scenarios combining outdoors and indoors activities using ubiquitous computing technologies together with stationary computers.

The learning objectives for these activities include the exploration of concepts of height, perimeter, area, and volume in order to design a new building for the university. Students use both mobile devices and traditional methods to guess, measure, and calculate the different parameters. Rich mobile content supports the learners in their activities. Additionally the students can use the camera in the phone to collect patterns and objects to be used in the design of their buildings. Once the students have determined the volume of the planned building in the outdoors setting, they return to the classroom and their data is imported into Google Sketch Up, a 3D design tool. The students then proceed to design a building using this tool and the photographs they took as textures. When they finish their designs they can visualize the building in a simple mixed reality tool by using a special barcode and webcam from their workstations. This allows group discussions, reflections about their buildings, and the learning activity.

The critical appraisal regarding the outcomes of our work is analysed according to micro, meso and macro perspectives. These different views enable us to look at the users´ and the learning opportunities, and the potential impact on educational practices. This assessment includes reflective interviews conducted throughout the co-design process with the different team members. Critical observations of the learning activities combined with interviews and data collection techniques. The GeM project has helped us to gain valuable insights regarding how novel learning activities can be integrated into actual math curriculum. The project also helps in our development of an authoring tool that enables teachers to design a broader range of activities that support different learning trajectories combined with tools for assessment.

Co-Design Practices for the Development of Mobile Open Inquiry-Based Learning for Ecology

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ABSTRACT
Mobile devices are well suited for supporting science education since learners can pervasively collect, visualize, and analyze data in the field. Learners also have access via these devices to a variety of educational resources, as they develop new ways to participate in collaborative learning activities. In this paper we present the initial phase of our LET´S GO! an international project (Learning Ecology with Technologies from Science for Global Outcomes). In the coming three years, the project will develop the notion of "open inquiry" in the field of ecology for K-12 students, through the design of engaging collaborative learning activities supported by mobile and sensor technologies to take place in Sweden and the United States.

We are developing these activities through a co-design process, where teachers, researchers, scientists, and developers work together in a highly facilitated, team-based process to design inquiry-based, collaborative science education interventions in schools. We believe more successful and sustainable interventions may be developed through co-design by actively involving the stakeholders in all the decision-making and scenario building activities throughout the design process. Up until now, initial sets of co-design workshops have been conducted in Sweden and United Stated with teachers, researchers, scientists, designers and developers. Through a structured and systematic brainstorm approach five concepts were fleshed out and resulted in the identification of a set of general functional requirements. We are using this emergent initial specification to conduct a series of small scale trials in both locations with two pared down scenarios to begin the next phase of our co-design process. Brainstorming sessions were documented with video, photographs and interviews to capture substantive and interactional dynamics. A sample scenario enables students to investigate water quality at a local stream using mobile sensors, pen-based technologies, and geo-tagged image making that are integrated into an interactive learning environment that supports inquiry-based learning with reflection and discourse. Analysis of the cross-cultural practices observed in the workshops is underway, as well as the development of the supporting infrastructure - both technical and pedagogical.

The next step includes carrying out pilots of potential curriculum activities with small groups of students using a variety of devices, such as scientific measurement instruments, probeware, digital pens, and mobile phones, among others. These pilots will be evaluated with video, photographs, and worksheets for the students along with structured interviews to further develop both the learning aims and functional requirements. These results will be shared with the team to help in the next round of participatory workshops.

These workshops and pilots will provide us with alternative ways to sketch out the ideas generated during the brainstorms by letting the teams envision the future from a socio-technical perspective and hopefully provide innovative results. Although these methods are highly participatory in nature, it is important to highlight the importance of the iterative cycle of design where relevant expertise needs to be applied across the concepts by designers, researchers, and domain experts before being refined and reinvented by the team.

A Picture of Mobile Learning in Italy: We need it!

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ABSTRACT
In the last decade m-learning has become an important field world-wide; however in Italy the panorama of m-learning is not clear yet. No one has made a complete picture of the field: it is not clear "who does what?, how?, where? and when?" in our country. We want to fill this gap; our idea is to realize a commented bibliography about m-learning in Italy.

Author Keywords
Commented bibliography, Italy

BACKGROUND
In the last decade m-learning has become an important field world-wide, however in Italy the panorama of m-learning is not clear yet. No one has made a complete picture of the Italian m-learning field: it is not clear "who does what?, how?, where? and when?" in our country. Our idea is to realize a commented bibliography about m-learning in Italy.

METHODOLOGY
The process which will lead to the creation of the commented bibliography is articulated in the following steps: 1- Identification of the fundamental thematic areas of m-learning; 2- Collection of the texts about m-learning made from people who work in Italy; 3- Classification of the texts in the thematic areas; 4- Addition of comments to the texts.

CONTRIBUTION
The project is ongoing. We identified the following thematic areas:

- GUIDE LINES (Key words: government research and guide lines). This area collects the documents published, with the aim to give a valid support to solve problems connected to the process of innovation in Italy, by institutions and associations to help people orient in distance learning education.
- TECNOLOGICAL ELEMENTS (Key words: Platforms, Standards, Learning Objects, Open-source). This area collects texts concerning technical questions. However, we are sure that most of these texts can also be useful for those people involved in instructional design, a few technical concepts will help them to perceive how technology can limit or expand educational opportunities and methodologies of m-learning.
- EDUCATIONAL PRODUCT (Key words: Contents Production, Instructional Design). The Instructional Design is the application of the principles and theories of learning and teaching to the development of training. The Instructional Designer works primarily in the organization of training, in defining the tools, in the technological architecture, in the storyboard, with the aim of creating effective training experiences.
- LEARNING PROCESS (Key words: Methodological aspects, collaborative approach, tutoring). If you want to conduct m-learning training or engage in activities of tutoring, you must have a certain familiarity with the communicative dynamics of communication via mobile device and be able to handle situations that respond to training with very different rules from those of traditional instruction.

EVALUATION
We are doing our best to find as many digital and paper texts as possible about m-learning, though of course some will go unfound.

REFLECTION
We believe this work is very important for two reasons. First, we are sure that any kind of learning, be it face to face, e-learning or m-learning, is connected to socio-cultural factors: this is why a national perspective is so relevant. Second, we think that if people who work in m-learning in the same country have a clear picture of the "immediate surroundings", they can improve the quality of their work and of education in their country.

Involving Parents through Mobile Phones.....What do Students Think About This?

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ABSTRACT
Following the theoretical principles of the Grounded Theory, our research question was to understand how young people articulate their discourses around the possibility of using mobile communication in home-school relationship. We conducted two focus groups, involving students from two high schools. One school is in Milan, a big city where social control is very weak, while the other is in Piacenza, a small city where social control is very strong. We found that mobile–mediated home- school communications are more accepted in Piacenza because they don't really change the status quo. In Milan they are more useful, but less accepted, since they change the status quo.

Author Keywords
Mobile mediated home- school partnership

BACKGROUND
One of the most prominent features of contemporary schools is that students are born and raised within a context which gives for granted, and considers as "natural", the existence of ICT and the Internet. Following the theoretical principles of the Grounded Theory, our research question was to understand how Net Gens articulate their discourses around the possibility of using ICT in general and, specifically, mobile communication in home-school relationship.

METHODS
A qualitative approach to research was chosen and carried out using the focus group technique. Standard content analysis was then performed.

CONTRIBUTION
We conducted two focus groups, involving students from two high schools. One school is located in Milan, a big industrial city in the Northern part of Italy, while the other is in Piacenza, a much smaller town about 70 kilometers south from Milan. The main points were: 1. How do you see the parents-school partnership? What is its purpose? How is it now, how you do you wish it were? 2. How do you see mobile communications in school-parents relationships?

RESULTS
A big difference between Milan and Piacenza is the level of social control. In Milan social control is very weak. In small cities like Piacenza almost everyone knows you, and/or your family and friends, so there is a very strong social control. In general, students are somehow ambivalent regarding home-school connections: on one hand, they are afraid to be limited in their freedom about bad marks at school. On the other hand, they recognize that "it is correct if families are kept duly informed". In Milan new mobile technologies are used more for control, without which it would be practically non-existent. In Piacenza new mobile technologies are mostly used for practical and organizational reasons. Students in Piacenza are used to social control and would not even think that it could be avoided. Therefore, they are less worried than Milan students about home-school mobile mediated communications since this type of communication would not change their situation very much. In Milan, it is clear that the "indispensable" cellphone is no longer a good thing when it is used to communicate behind students' backs. They consider the use of cellphones as a violation of their privacy and an intrusion in children-parents relationships. In particular, we found that mobile–mediated home- school communications are more accepted in Piacenza because they don't really change the status quo: the situation is already under control. In Milan they are less accepted, but they are more useful, they change the status quo.

REFLECTION
The sample involved in this research is a quite limited one. However, there is a strong potential for further development of a deeper understanding of the cultural basis of mobile-mediated home-school partnership.

Projecting Knowledge: Mobile Projectors, Space, and Collaborative Learning in Museums

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ABSTRACT
This paper explores how emerging projector technologies may be used in conjunction with mobile phones to enhance collaborative learning interactions in museum spaces. Building on the notion of the screen as a spatial feature and mediating tool, the study is conducted through a series of design workshops.

Author Keywords
Museum, space, mobile, projector, learning, design

OVERVIEW AND BACKGROUND
As computers, mobile devices, and digital media have become more commonplace in museums, the significance of the screen as a mediating tool has increased. The screen and its relationship to museum architecture, exhibition space, knowledge representations, and social interaction, serves as the background for the design research study described in this paper. The aim of the study is to explore how emerging projector technologies may be used in conjunction with mobile phones in ways that may enhance collaborative learning interactions with shared knowledge representations in museum spaces. Specifically, the study explores and identifies collaborative learning affordances of pico-projectors (handheld projectors) in situated spatial-learning settings in museums.

A sociocultural perspective on learning frames our examination of the relationship between physical space and interactions mediated by mobile phones and screens in museums. From this perspective, we consider mobile phones and screens as mediating tools through which visitors engage in the various social, physical, and learning interactions afforded by the museum. Within this broader context of thinking about physical space as supporting these learning interactions, screens are conceptualized as both a spatial and technological feature. The following research questions are addressed in this study: How might learning collaborations be organized in museum spaces using mobile projectors? Which types of exhibit interactions are afforded by the use of mobile projectors?

PROJECT STUDY
A series of design workshops were conducted following Future Technology Workshop methods (Vavoula et al, 2007), and incorporating The World Café methodologies (Brown et al, 2005). These exploratory workshops involved 8 children grouped as 12 and 15 year-olds, along with 9 experts in museum design, research, and education as well as from the mobile phone industry. The workshops included activities of role-play, scenario building and discussion along with play and manipulation of pico-projectors and phones. Participants also created and performed tasks in simulated museum spaces. The sequence of workshop sessions was designed to ensure that generated concepts were not restricted by current conceptions of existing technologies and museums. Previous research on visitor interactions with screens informed the design of the planned activities. The data includes video, observations, notes, group interviews, along with the ideas and products generated through these sessions. This data is analyzed using interaction analysis methods.

CONTRIBUTION
An evaluation of the project and reflections on potential for further development will be presented at the conference. Findings in this study will contribute to design principles suggesting how screens and mobile projectors may be incorporated into productive mobile learning interactions that are situated in museum spaces. More broadly, the hope is that these findings will be representative of an entire system of museum spatial features that support mobile learning.

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Using Darwin Information Typing Architecture (DITA) as a Format for Mobile Content

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ABSTRACT
In this paper we will discuss the use of the Darwin Information Typing Architecture (DITA) eXtensible Markup Language (XML) schema for use in the delivery of content to mobile devices. The flexibility of XML and the simplicity of the DITA architecture make it an ideal candidate for rendering across the wide range of mobile devices.

Author Keywords
Mobile, DITA, XML, iPhone, IETM, Technical Manual

BACKGROUND
Mobile content delivery presents a variety of challenges to developers. With a wide range of devices, the challenges of screen size, browser capabilities, connection speeds and input methods present a complicated matrix for content developers. Rather than a developer focusing on the device, it became clear that an easier task would be to focus on the content structure and delivery.

METHODS
Looking at the variety of delivery options (Flash, HTML, etc.), the idea of an XML based format seemed to make sense due to the flexibility of the format and ease of styling to a specific viewport. The DITA specification stood out as a target for a few reasons; it is an open standard with broad acceptance, it is simple, and there are learning objects in the schema (albeit in a proposal stage at the time of this writing). Additionally, because Cascading Style Sheets (CSS) can easily be applied to the XML document, it means that formatting the content to a particular window size can be approached from an easier, more modular fashion that can be delivered from either a server-side application or a native device based application. Additionally, the flexibility of DITA suggests that it would be possible to directly import elements from native Interactive Electronic Technical Manuals (IETM) conforming to the DITA standard.

EVALUATION
To date implementation of this concept has been executed rather successfully and pushed across a number of platforms. The small XML file size of the data, usually task-based job aides, has proven to be the appropriate type of information for this endeavour. The task orders, each augmented by three levels of detail that can be accessed by the user, allow a presentation of data that enables the user to obtain the required information without being overwhelmed by volume.

REFLECTION
As we proceeded with development, we found the limitations of different browsers in regards to CSS standardization to be quite frustrating. Additionally, the simplicity of DITA made the content, at times, a challenge to map out. However, we also found that, despite our initial mobile target platform being the iPhone, many of the browsers we tested worked with no required modifications to the original code. Additionally, because the DITA source content is so flexible, it has allowed us to deploy the same content to desktop-based web browsers with little modification to the code thereby expanding our audience.

An Event-Based Hub for Mobile Access to Teaching and Learning Resources in a VLE

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ABSTRACT
At the end of 2008 it was estimated that there were 4 billion mobile phone users worldwide. Today's young people are using their mobile phones for communicating by voice, text and multimedia. There is considerable potential to extend the use of this device to support education. In particular, if the mobile phone can provide an interface to an online learning environment a whole new dimension in respect of remote access to education is unlocked.

The University has expended considerable effort in development and delivery of innovative learning environments optimising use of its Virtual Learning Environment (VLE). In recent years, there has been an increased reliance on electronic delivery of teaching and communication between staff and students focused around the VLE. Currently 27,000 students have access to 7692 online modules. In recent years there has been increased emphasis on the development and delivery of new tools and services to support both academics and students. This has led to addition of services for voice interaction, social networking and wiki areas to support formal teaching and informal communication.

The increased uptake of mobile computing among the student population is driving the need for a more flexible service, available to all users, regardless of time or location. Mobile phones are useful computers that fit in your pocket, always with you, and always on. As mobile working becomes more pervasive, Institutions need to further extend access to their learning environment in order to support a demanding mobile user base.

The University is developing and evaluating a mobile hub for its VLE. This hub provides a central access point for all mobile users allowing students and staff to check for new items of interest in the following: mail, announcements, exam results and calendar events. Users are able to connect to the VLE as they normally would from a computer using a handheld mobile device, keeping up-to-date with the most recent changes to their teaching and learning portfolio. The mobile hub contains device-sensing capabilities to provide each user with the richest interface experience possible for the device they are using and to connect disparate learning-based resources in one point of access.

Large classes often lead to a lack of cohort identity and students rapidly become disoriented and unmotivated, resulting in discontent and in the worst cases, withdrawal from the course. A system is currently being developed with collaboration and feedback from staff and first year students. By providing a flexible mobile login to the VLE, students and staff receive context rich information, which acts as an alert for further proactive engagement. Furthermore by providing more flexible and accessible means of communicating with students whilst 'on the move' it is anticipated that student satisfaction (and ultimately retention) will improve.

In addition to quantitative monitoring of the use of the mobile interface, in-depth focus groups with staff and students will provide valuable qualitative feedback on the type of devices used and the nature of the information accessed, thus highlighting areas for refinement prior to widespread rollout within the Institution.

Enhancing Student Communication via SMS with Mobile Technology

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ABSTRACT
Many institutions recognise problems communicating with students from a Faculty administration and an academic perspective. Administrators find it difficult to monitor student attendance whilst Academics find it difficult to keep in contact with students using more traditional methods of communication such as letter and email. Many students don't check their University email account and numerous days can pass from when an email was sent until it gets read, meaning important dates and deadlines are often missed.

Students today expect an instant response using up-to-date technology they are familiar with. Recent research highlighted that all students owned at least one mobile phone device, and cited SMS as their preferred communication method over voice calls. Furthermore, all those surveyed expressed an interest in receiving SMS communications from the Faculty, in support of their educational needs and would be prepared to reply or provide feedback via SMS. SMS technology is extensively used in FE and HE institutions throughout the UK in a wide variety of learning situations.

A two-way SMS system incorporating a plugin to WebCT is currently in development and will be implemented to allow staff to instantaneously contact students and receive replies. The system will improve communication with students in a personalised and time effective manner. It will help foster better student/staff relationships, improving class/seminar attendance while providing Administrators with an easy method of monitoring student attendance records.

Using innovative SMS technology, that students are familiar and comfortable with, will improve communications between students and staff in all Faculties and departments within the University. Supporting at risk students, in all courses, by enhancing interactivity within the classroom will ultimately improve student retention figures.

The project will be piloted with Faculty Administration staff and Academic staff. There will be an evaluation of the project aims and outcomes via a focus group involving all staff members involved. Data will be collected relating to how long it takes to make contact with students via SMS in comparison to other communication methods such as email and letter. Attendance figures concerning at risk and non-attendee students will be analysed to assess whether instant SMS communication has made a difference to class turnout patterns.

Students will be questioned at specific times regarding their views on both receiving and sending SMS messages. This questioning will take place through sending SMS messages to students for feedback and by holding focus groups with students. They will be asked how willing they are to receive these messages, whether they feel supported by the University by receiving regular communications via SMS and how willing they are to reply to SMS messages. They will also be asked if they felt the University provided a personal service that influenced their attendance at seminars.

The study will be evaluated and findings will be disseminated through other faculties/departments for further roll out university wide.

The Role of Reading and the Potential of Portable Ebook Readers in Mobile Learning

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BACKGROUND
The variety of highly portable reading devices is now remarkable – Amazon Kindles, iRex iLiads and Sony Readers are but the most well known. At the same time there are continuous and extensive discussions about levels of reading proficiency and how it might be impacted by such new technologies, especially amongst the young. Though it would seem obvious that there might be a link between the two, such discussions typically suffer from being too general, ignoring differences in type of reading, in the contexts of reading and hence also in relevant or appropriate measures of reading proficiency. Reading an SMS is clearly different from reading a novel as it is different from reading a textbook. In this paper, we want to report an examination of eBook readers from the perspective of 'mobile learning'. It seems that eBook readers and their role in mobile learning have not been examined very greatly from this perspective.

METHODS
We will provide insights into the research questions firstly by reviewing literature related to the subject and secondly, by analysis of materials derived from interviews with seven experts representing the fields of mobile learning, educational technology, reading, and eBooks.

CONTRIBUTION
We suggest that the role of reading and eBooks in mobile learning can be seen from two viewpoints: the first related to the type of reading and the second related to the valuation of reading. *Type of reading* taking place in mobile learning contexts is by character:

- **Task-oriented**; reading which links to the situation and context (such as reading instructions)
- **Fragmented**; reading fragments in short periods of time
- **Skimming**; reading relatively quickly, searching for information and guidance related to the task
- **Conversational**; interacting with the context, technology and people by reading and writing
- **Tailored**; reading which adjusts to the personal needs and interests in context

The current crop of eBook readers does not support all these types of reading. There is a lack of features which properly adjust the devices in question to the learning contexts. The *valuation of reading* is a much harder matter to analyse. The literary review does not reveal many insights into valuation for example. And, according to the interview data, reading as an activity is not much emphasised in mobile learning either - it is rather only a part, perhaps a small part, of the task in question. Deep, reflective and time-consuming reading is not core to mobile learning activities.

EVALUATION AND REFLECTION
When placed within the larger topic of reading proficiency in the general, there are at least two possible directions that derive from our research: 1) adjusting and integrating reading to learn through the use of revised mobile technologies. In this choice, both the design of eBooks and reading to learn processes and goals would need to change; or 2) acknowledging that more reflective and more time-consuming reading is a separate activity, parallel to other less reflective and short lived reading forms, including that in mobile learning contexts. In this view, questions about reading proficiency cannot be answered by treating reading as a singular activity.

Keywords
EBooks, reading, reading proficiency, contextual learning, mobile learning, education

Personal Inquiry: Lessons Learned

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ABSTRACT
The paper describes a school trial in secondary to school to explore how version 1 of the PI Toolkit helped students to perform a personally relevant scientific inquiry in a science classroom and at home. Over a three-week period (nine lessons), twenty one 13-14 year old students in an inner city school participated in an inquiry to answer the question "how healthily do I eat?"

The lessons were structured around an Inquiry Guide, reflected in the design of the toolkit and the lesson plans. The Inquiry Guide designed to align with the aims of the inquiry, shaped by the teacher's need to work within a specific vocabulary and by the style of her teaching. It specifies activities that take place during an investigation such as data collection, and analysis, and highlights the iterative nature of inquiry – a simplistic stage-like progression is replaced by an iterative one where phases are repeated until students achieve satisfactory outcomes. For example, if students collected data and try to analyse it but subsequently realised their data set is inadequate, they can go back to data collection phase and collect more data until they can pursue their analysis.

The PI Toolkit guided students through the complex process of carrying out their inquiry. It provided adaptive navigation (available options change in the light of student's actions) through the phases of inquiry including past, current and future activities. . The Toolkit was implemented in Drupal, an open source CMS, accessed through a browser using a combination of pre-existing and custom built modules. It was run on a local web server installed onto an Asus EEE ultra mobile PC. In addition to this we gave the students a digital camera in order to record what they ate.

A variety of measures were taken to explore how the toolkit was used by students to inform subsequent redesign of the system; this included multiple video tapes from classroom and teacher and students interviews. These were used in a critical incident analysis of learning breakthroughs and breakdowns (Sharples, 1993; Anastopoulou, 2008) to derive design guidelines that resolve challenges for implementing personal inquiry learning. Three themes have emerged,

1. **Co-ordination across contexts:** These are pragmatic issues when trying to connect school activities with activities outside the classroom. For example, students were initially enthusiastic about taking the technology home but became bored with carrying it around , with the result that crucial technology or information was not always available
2. **Co-ordination within contexts**: Apart from designing activities to support the transition from one context to the other, it is also important to facilitate technology-mediated activities within the school or home context.
3. **Revealing identity:** For the students to undertake work beyond classroom settings, it needs to be engaging and personally relevant. But, an activity that is too personally revealing can cause embarrassment, leading to reluctance to share the results, or even capture the data. This has serious implications for student's learning.

These results have provided a number of concrete design proposals for both the pedagogy and technology which will be incorporated into the next iteration of the PI Toolkit and are likely to have relevance to other researchers interested in support inquiry learning across multiple contexts.

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MuseumScouts – Students Using Mobile Devices to Support the Creation of Teaching Resources from their Research in Museums and Field Centres

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ABSTRACT
Many location-based mobile learning projects such as Mudlarking in Deptford (Sprake, 2006) and MyArtSpace (Sharples et al, 2007), which both involved secondary school students in the UK, refer to online follow up activities that take place subsequent to the location based experience. The focus of this paper is on using the creation of peer teaching resources as such a follow up activity. This involves the students transforming their location-based learning experience into a representation intended to teach others and thus embedding the learning.

The MuseumScouts project (http://museumsscouts.org) involved teachers, teacher educators, students and researchers from five European countries: Germany, Lithuania, Portugal, Austria and the UK working with museums of different kinds including science centres and historic buildings. During a 'museum' visit students (10 - 19 year olds) researched specific artefacts, using a range of devices from pencil and paper to Smartphones to gather information in the form of notes and photographs. They then worked in teams using their notes and images to create interactive multimedia presentations about the artefacts to inform and quiz their peers. In this project the students used the online authoring tool 'Evolution' however the widely available application GoogleSites offers similar opportunities. The software enables students to collaborate online, sharing their images and designing presentation slides and multiple choice tests together. The underpinning principle is of 'learning by teaching'; the idea that considering how to convey to others what you have understood yourself is an important process for 'deep' learning.

Locations visited by students ranged through a monastery, a water park, a science centre, a variety of city museums and art galleries including an art restoration centre. Exhibits they researched included Ancient Egyptian artefacts, paintings, interactive demonstrations of electricity, stuffed animals, shoes, buildings, wildlife and water treatment. The museums were, in general, very supportive and willing to co-operate wherever possible. Some of them had staff dedicated to outreach and educational activity, but by no means all. In general museum staff worked directly with the teachers and their students and were happy to share their expertise.

The mobile device used most successfully to capture information for future use in the short multimedia presentations was the lightweight, hand sized digital camera. Whilst many students used their mobile phones to capture images and video on location there were interoperability issues between the image formats and the 'Evolution' software. Similarly with video only this was compounded by large file sizes and the students' lack of forethought about depth of field, camera angle and camera shake etc.

Peer teaching resources were created in all five countries, where students suffered connectivity issues with the online software Evolution they reverted to more familiar software such as Powerpoint. The project as a whole was evaluated through participant observation and an online survey of teachers and students. Of the project aims it was clear that the students surveyed (n= 120) perceived working with authentic artefacts in the museums visited to be more important to their subject learning than learning by developing presentations with quizzes for their peers. This was confirmed by the teachers who strongly agreed that engagement with the artefacts in museums was related to student learning. However, all the teachers agreed that the need to create questions to assess learning and the need to research information for the follow-up interactive presentation supported student learning. Most teachers (15 out of 17) also agreed that taking your own photographs was important to learning.

Author Keywords
Museums, location-based learning, mobile phones, digital cameras, online collaboration

Mobile Game Based Learning for Peer Educators of the Males having Sex with Males Community in India

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ABSTRACT
This project is about designing and evaluating an SMS game on mobile phones for use by *Peer Educators* (PE) from the *Males having Sex with Males* (MSM) community in India. MSM are group at high risk of HIV and peer educators are members of the same group but working as 'agents of change' to enable safer sex behaviours.

Author Keywords
Mobile game based learning, peer education, Males having Sex with Males, HIV/AIDS

INTRODUCTION
The aim of the study is to design and evaluate learning support for PE of the MSM community in India, using a blended approach of mobile technology and experiential and dialogic learning. The expected outcome of the project is to develop an effective PE learning support. Peer education is one of the main components of the national HIV control initiatives in India, especially for 'hard to reach' marginalized communities as MSM. MSM refers to males who engage in multiple partner change and unsafe sexual practices. Peer education involves using members of the same group to effect behaviour change among other members. However, despite its growing popularity, little is known about the processes of peer education, specifically, the problems or difficulties faced by them. Reports show that PE need ongoing learning support. Learning support involves practical skill development during PE outreach work which existing training often fails to do. This participatory research involving MSM organisations from Kolkata, India aims to explore how mobile game based learning can best assist the PE in their roles. The SMS game is being developed to provide simulated scenarios of the PE practical experiences. The SMS game is adopted from the *Day of the Figurines* developed by the Mixed Reality Lab, Nottingham University. This is a multiplayer board game played using text messages on mobile phones. It is set in a fictional town and the game unfolds over a twenty four days in the life of the town. On the board, each player chooses and subsequently controls (via SMS) a figurine that represents their character. The characters roam the streets in the town, encountering events and defining themselves through their interactions to other figurines, visit destinations, find and use objects, resolve dilemmas and undertake missions. The SMS game for the PE is aimed to simulate practical experiences of MSM PE in Kolkata, India.

METHODS
The research is planned in three phases. First, to collect baseline data; second, to pilot and implement the SMS game; and third, to evaluate effective learning. The first phase of the study, to collect baseline data on the learning needs of the PE and to explore peer education in the Indian MSM context, was carried out during June 2009 in Kolkata. *MANAS Bangla*, a network of MSM organisations in Kolkata, was contacted. Twelve semi-structured interviews were conducted with *MANAS Bangla* PE to explore peer education and to identify key themes of learning needs. A thematic analysis of the interviews were conducted (1) to identify understandings and practices associated with peer education in order to explore peer educators' understanding of their work and role, and (2) to generate an initial set of learning needs to assist with game development. The initial set of learning needs were explored, refined and prioritised by peer educators during two subsequent group discussions. The game design is an iterative process. Two Game Design Workshops were conducted to develop simulated scenarios of the PE experiences based on 14 issues that were prioritized during the FGD. Nine destinations in Kolkata were selected as game destinations. Further work is under progress to pilot, implement and evaluate the SMS game among the MSM PE.

CONTRIBUTION
This research is an innovative way to explore how mobile game based learning may contribute towards enhancing the knowledge and skills of the PE of a 'hard to reach' MSM community in India.

REFLECTION
Limitation: Since most of the MSM conceal their identity, getting frequent SMS messages from the game might interrupt the PE at times not appropriate. In addition, playing with players with low literacy can become a challenge.

Success: Map out the success and failure criteria of using mobile game based learning for a hard to reach population.

An International Survey of Mature Students' Uses of Mobile Devices in Life and Learning

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ABSTRACT
The paper presents research concerned with learner-driven innovative practice with mobile technologies and the interface between formal and informal learning. We build on our previous work investigating student use of personal devices for learning, work, social interaction and entertainment. A recent phase of the research included an international survey focusing on students registered on selected Masters and doctoral programmes in the UK, Sweden, Portugal, Hong Kong and Australia. The research gives an account of everyday uses and more unusual deployments of personal technologies by students from departments of education and technology. It illuminates learner choices and preferences, attitudes towards work–life boundaries, evolving social and cultural practices, and the impacts of technological change.

Author Keywords
informal learning, community learning, learner-driven innovation, work-life boundaries, questionnaire

SHORT PAPER
This paper takes forward research agendas concerned with learner-driven innovative practice with mobile technologies and the interface between formal and informal learning. We build on our previously reported work investigating student use of personal devices for learning, work, social interaction and entertainment. A recent phase of our research (2008–9) included an international survey focusing on students registered on selected Masters and doctoral programmes in the UK, Sweden, Portugal, Hong Kong and Australia. The research gives an account of everyday uses and more unusual deployments of personal technologies by students from departments of education and technology.

The International Survey was conducted by means of an extensive online questionnaire, adapted from the one used for our study in 2005. It has enabled the capture of qualitative and quantitative data on the use of various mobile devices in diverse spheres of activity; the workings of communities and groups; frequency of specific actions; activities that respondents wished to identify; and reflections on benefits and problems encountered. Qualitative data was analyzed by identifying recurrent themes and noting points of tension. Student participation in the research was voluntary and unconnected to study progress or assessment. A total of 270 students, mostly aged 25–44, have completed the questionnaire. The research illuminates learner choices and preferences, attitudes towards work–life boundaries, evolving social and cultural practices, and the impacts of technological change. It confirms the global popularity of SMS, listening to music, taking photos and setting reminders. It also highlights that web-browsing and reading e-news are fairly common and that article- and book-reading and note-taking, once considered implausible on handheld devices, are popular among a minority and may even encourage reading. Mobile devices are shown to support informal and community learning. Some community activities were deemed impossible without a mobile device.

The research provides good evidence of a contrast between claims that mobile learning can take place 'anytime, anywhere' and reported practice which often describes irregular usage dependent on a range of factors. From a global perspective, the research suggests that local economy, social mores, and learners' local knowledge, shape the frequencies and specifics of use. We are not attempting a direct comparison between different countries; however, we have found that by considering apparent differences we have been able to articulate questions about the impacts of social, cultural, and economic factors on learners' use of mobile technologies. Such awareness can make researchers and teachers more sensitive to different circumstances facing students who are studying remotely or spending time away from their usual place of study, and can help practitioners designing learning for culturally diverse cohorts. Adapting a previously trialed questionnaire meant that the quality of data collected was generally good, whilst follow-up interviews with students can complement and extend this data. The present investigation leads to various hypotheses for future research, including possible differences in communication choices depending on gender and age.

Implications of Utilising PDAs in Computer Programming at CPUT

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ABSTRACT
A global assessment of the use of mobile learning (m-learning) in higher education has brought into sharp focus the ever increasing use of mobile handheld devices in higher education across the world, including developing countries like South Africa. Despite its increasing popularity, relatively little research has been conducted into the utilisation of mobile handheld devices in computer programming subjects at higher education institutions. As the capabilities of mobile handheld devices increase, their value as a potential teaching and learning aid is increasing exponentially. According to Ford and Botha (2007), there is "a need for new approaches to integrate technology into the classroom, particularly in an African environment." It is therefore imperative to identify different ways in which these devices could be introduced into programming subjects to contribute toward and enrich the learning environment of learners.

This short paper presents a preliminary study conducted at the Cape Peninsula University of Technology (CPUT) on the use of mobile handheld devices (PDAs) in an undergraduate computer programming subject. In this study, PDAs preloaded with Basic4PPC software enabled and encouraged first year learners to design, develop and electronically submit mobile applications anytime, anywhere without the necessity of a computer.

This study, based on Action Research, investigates the wide reaching implications of utilising mobile technology for teaching undergraduate programming to predominantly previously disadvantaged learners. This study explores learners' views and perceptions of the educational value of PDAs, the possible advantageous alternatives mobile handheld devices can provide to traditional programming instruction, and the potential barriers to its use.

This study was conducted mainly within the qualitative paradigm. Data was collected using a range of methods. Learners' responses and activities were collected by means of questionnaires, interviews and video-observations to evaluate learner satisfaction with the m-learning environment, the usefulness and usability aspects of mobile handheld devices as a learning tool in a programming subject, as well as how learners interact with these devices. Initial results suggest that mobile handheld devices can be utilised as an acceptable complementary educational tool in a programming subject and that learners' reactions toward these devices are positive and may increase their enthusiasm and motivation to work and learn. This paper concludes with a review of current progress and an outline of achievements and challenges so far.

Ideally, future research needs to investigate if PDAs, equipped with text messaging software, can be used to improve out-of-class communication between instructors and learners, and in addition also increase learners' programming problem solving skills. Further study is also needed to determine the critical success factors of mobile handheld devices, the patterns of use of these devices when utilised by learners, as well as the extent to which these devices can add value in teaching computer programming.

Author Keywords
Mobile learning, mobile handheld devices, PDA, programming

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Tablet PC's, DyKnow and Collaborative Learning: Developing Mathematical Problem Solving Skills in Large Undergraduate Classes

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ABSTRACT
Teaching mathematical problem solving skills to large undergraduate classes involves many challenges, and attrition rates in these courses can be high. Students from diverse backgrounds can struggle to achieve successful outcomes in such teaching and learning environments, particularly in trans-disciplinary, concept-dense areas of study such as Engineering, Maths and Science (EMS). Large classes in these disciplinary areas create particular challenges for lecturers to move beyond passive forms of teaching and provide little opportunity to engage students. In 2008 the University of Queensland made a successful bid for an invited Hewlett Packard Teaching with Technology Grant, and was awarded twenty tablet PC's as part of the grant. As this was a very small number of tablet PC's given the size of the class (400 plus), it was decided to integrate the tablet PC's into a selected number of tutorial classes (approx 20 students per class) to trail their impact on supporting the development of complex mathematical problem solving skills. It was also decided to investigate the use of an interactive teaching tool, DyKnow, a little known technology in Australia, with the tablets to investigate the potential of the combined technologies to create an integrated learning environment.

Nine of the twenty five tutorial groups participated in the trial. This involved 144 students, the lecturer and five tutors. Unlike many projects of this nature where staff initiate the intervention, staff were allocated to tutorial classes and asked to participate in the DyKnow training sessions and use the new technology and adopt more collaborative approaches to teaching and learning. The lecturer was an enthusiastic supporter of the intervention. All staff participated in a comprehensive online training session for DyKnow, which included learning the features of the software and using the software to conduct a learning session. The focus of this training session was very much on active and collaborative learning. In order to further encourage collaborative learning approaches it was decided to allocate one tablet PC per pair of students. Students could self-select their pairs.

Tutorial classes were redesigned to include more active and collaborative teaching and learning strategies, however little change was made to assessment strategies. A number of different structures to include more active and collaborative tutorial activities were initiated. One technique engaged students by providing opportunities to critically compare data sourced from various websites while solving open-ended problems. The use of DyKnow to form small collaborative learning groups was also successful. Students were given a problem then worked in pairs to write their own solutions. Using the technology, they then combined with 4-5 other pairs to agree on one "model solution."

An evaluation matrix was developed to conduct a comprehensive evaluation of different aspects of the project. The evaluation focused on approaches to assessing changes in staff and students perceptions pre- and post-project and identifying the impact the use of tablet PC's, Dyknow and collaborative approaches to teaching and learning had on student learning outcomes and the educational practices of staff. Amongst other strategies, including observations and focus group discussions, a participant perception indicator was used to identify staff and students' knowledge, experience and confidence in relation to tablet PC's and active and collaborative learning. It was administered to staff and students pre- and post-project.

The project had successful outcomes in relation to improving mathematical problem solving skills and to changing teacher practice in particular. Analysis of final results indicates that students from the tablet tutorial groups consistently performed above the class average, by an average of half a grade.

Author Keywords
Mobile learning, DyKnow, collaborative learning, mathematical problem solving, learning spaces

Linking Different Learning Contexts Through the Use of Mobile Technologies to Enhance Competency Development in Clinical Practice

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ABSTRACT
Increasing student numbers together with limited workplace clinical placements in specialty areas such as "Voice Disorders," have necessitated the introduction of innovative models of practice education. One such innovation is a standardised patient program, whereby actors are carefully trained to portray a patient or an aspect of a patient's condition according to educational need. Integral to practice education is evaluation of "what" and "how" students are learning and the creation of opportunities to extend learning beyond the scheduled clinical sessions.

The overall purpose of this project is to utilise students' own mobile technologies to support clinical learning and competency development. This project has a focus on enhancing the development of clinical reasoning and reflective practice and in facilitating the integration of the knowledge and skills required for professional practice with clients with communication disorders. Third year undergraduate students (enrolled in a 4 year Bachelor of Speech Pathology program) undertaking clinical practice in a standardised patient "Voice clinic" utilised their mobile technologies to record events (e.g. case history interview with a standardised patient; demonstration of voice therapy techniques), that are of significance to them in their clinical practice, thus enabling them to personalise their learning according to their own needs and interests. These events were downloaded to a wiki on the course Blackboard site. Students engaged in a range of activities involving facilitated face-to-face small group work and on-line learning in relation to these recorded events. Students and clinical educators recorded their learning experiences and reflections in a digital diary (blog on the Blackboard site). These activities enabled students and clinical educators (CEs) to revisit events of interest to them in a supported learning environment that encouraged student and clinical educator engagement in practice education, reflective learning and the development of clinical reasoning skills.

To further support student learning, staff recorded a number of small vodcasts demonstrating particular voice therapy techniques that students could upload to their mobile technologies and use as prompts in the clinical setting.

An action research methodology was utilised, implementing the changes in teaching and learning practice in the pilot project and evaluating and reflecting on the outcomes to inform the next stage of implementation.

Quantitative and qualitative approaches to evaluation were used including surveys of students and clinical educators to determine access and utilisation of technology, the extent to which intended outcomes have been achieved, the appropriateness of the project activities in meeting project objectives, lessons learnt from the project and how these might assist others in similar projects. Focus group discussions provided further insights into the students' experiences.

This short paper will outline the results of the project and the impact of the technologies in linking learning contexts and creating a more personalised learning experience for students. The paper will discuss the staff and student experience including issues identified in integrating the different learning environments. It describes the learning activities developed for the first stage of the project and the future developments planned.

Author Keywords
Mobile technologies, clinical practice, contextualized and personalized learning

Markets, Mobile Distribution, & the Future of Higher Education

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A recently published report by SRI International examines the findings of 99 comparative studies measuring the relative effectiveness of online versus classroom instruction. Remarkably, the report concludes, "On average, students in online learning conditions performed better than those receiving face-to-face instruction."

The implications of these findings are far reaching. In the past distance learning has been promoted as a financial compromise, but now there is evidence to suggest that in addition to economic practicality, online learning may offer a superior instructional experience. These findings come at an opportune time. In 2009, mobile penetration has reached 60% of the global population, and the widespread adoption of open source mobile operating systems will expand the market for distance learning ten-fold.

The combination of these three factors is likely to fracture the current model for Higher Education, dividing the University into its constituent elements. Curricula, instruction, and assessment will increasingly become independent functions as "Academic Capital" replaces "Academic Labor".

The concepts of labor and capital as applied to academic resources are analogous to the development of pharmaceuticals in health care. The labor model of health care is predicated on the interventions of a highly trained specialist, whose capacity is fixed. A surgeon spends many years acquiring competence, and may only treat so many patients a day. But when specialists collaborate to produce a drug that can replace a surgical treatment, there is effectively no limit to the number of patients that can be treated. In the same way it takes a tremendous investment to train a professor, who can only teach so many students. But digital curricular resources are limitless.

Today, digital curricular resources are tightly bound to the institution, but this model will not endure. MIT is widely regarded as one of the leading engineering schools in the world. They have also taken a leading role in the Open Courseware movement, which provided full access to curricular materials for free. As these resources improve, there will be little reason for each institution to individually recreate the effort. Instead, a digital curriculum marketplace will manage the contributions of the diverse global participants leading to deep customization and highly granular content.

But to facilitate this shift there will have to be a shift in the mechanisms of assessment and accreditation. The institution-centric model fostered a philosophy of accreditation that focused on the resources and reputation of the physical infrastructure of the Academy. Facilities, sports teams, endowments, libraries, and the campus itself impose a huge economic burden on the individual student, and contribute little to distributed learning. For the digital curriculum marketplace to succeed, there must be a robust system of third-party assessment that separate the functions of instruction and certification.

By addressing curriculum development and assessment in this way, the marginal cost for additional students approaches zero. This, combined with the ubiquity of mobile devices will grant universal access to higher education. Such a shift is likely to meet some opposition from those invested in the institution-centric model, however it's the educators themselves who stand to benefit the most from this opportunity.

Without access to a common market, the "Crusoe Economy" struggles to provide the basic necessities. In many respects modern universities operate in this way, with each institution replicating the effort of the others in countless classrooms across the world.

This approach may become obsolete when digital curricula can be traded in a common marketplace. Scarce academic resources could be allocated more efficiently, improving the content available to everyone, and freeing teachers to focus on task that only humans can perform, like coaching and mentorship. A common market facilitates the transition from Academic Labor to Academic Capital, dramatically improving the quality and availability of higher education.

Research from the Institute for Simulation and Training will be presented demonstrating the viability of an "Academic Capital" model for higher education based on mobile devices, along with demonstrations of recent hardware and software developments.

Ethics for Mobile Learning Research – the Wider Context

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ABSTRACT
We revisit here the ethics of mobile learning research. Previously these ethics have been explored in a narrow academic context, to tease out the implications for this research of such core ethics topics as liability, consent and confidentiality. Ubiquitous, universal and diverse mobile devices are now changing the nature of many societies, specifically changing the ideas of identity and community; conversation and discourse; space, place and time; knowledge and information. Here we move outside this earlier context to explore the relevance of these changes to the ethics but also the methodological rigour of future mobile learning research, and provide examples and illustrations.

Author Keywords
Research ethics, mobility, etiquette, slang, fashion

BACKGROUND
Ethics embraces everything from the legally allowable as set out in laws, statutes and regulations through the institutionally and professionally advisable as set out in regulations, codes, frameworks and procedures all the way to the socially or culturally acceptable as manifest in such concepts as fashion, behaviour, etiquette and language. All aspects of ethics, especially the last, are important to individuals as expressions of identity, affinity and community and all these aspects of ethics are important to researchers because not only must research be seen as proper and moral, as within laws and regulations and acceptable by the research community but also research must be aligned to the ethical expectations of learner communities if it is be methodologically sound. In looking at the ethics of researching mobile learning, every researcher is facing in two directions, has two different sets of discourses and responsibilities. Firstly, each researcher works with and within the ethical expectations and formulations of their profession, their institute and their funder. Secondly, each works with individuals and communities using novel, complex and powerful technologies, individuals and communities that comprise a society increasingly transformed by the near-universal mobile personal technologies.

ANALYSIS
The first discourse is easy to understand: technological change is rapid and widespread, and drives social change, whilst mobile learning research is often multidisciplinary and multi-partner. Institutional ethics procedures are relatively static and perhaps falling behind this change and complexity but this first discourse is compounded by the second.

The literature of mobilities describes how societies are changing as increasingly powerful mobile systems become widespread and integrated into everyday life; inter-related notions of identity and community, conversation and discourse, space and time, knowledge and ideas are evolving; local physical and virtual worlds are intermingling; virtual groups are forming and dissolving; knowledge, ideas, images and issues are being generated and valorised by these fragmented and transient groups. For the mobile researcher seeking to work ethically and rigorously this implies the need for an increasing awareness of transient and fragmented specifics around, for example, preferences, punctuality, slang, privacy, fashion, place and status.

CONCLUSIONS
Mobile learning researchers must recognise wider social contexts in order to be aligned to the ethics of their academic responsibilities whilst being aligned to the ethics of the fragmented, multiple and transient communities and individuals with whom they research. This will ensure that their work is not only moral in the eyes of these communities and individuals but that this work is methodologically authentic and credible.

iLearn: A Content Analysis of the iTunes App Store's Education Section

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ABSTRACT
With over 1 billion Apps downloaded from Apple's App Store, and major children's entertainment companies diving into this market en masse, it is important to consider the role that Apps may play in children's learning. While numerous mainstream news and industry sources have started to provide anecdotal descriptions of what is available for children in the iTunes App store, none have done a careful analysis with a focus on educational content. This short paper is a content analysis of the education section of the iTunes App Store. It seeks to provide an up-to-date, reliable and unbiased analysis, and to act as a benchmark for change as the iTunes App store continues to grow and evolve.

Author Keywords
iPhone, iTunes, Mobile Learning

INTRODUCTION
The Joan Ganz Cooney Center at Sesame Workshop, a research and policy organization dedicated to advancing children's learning through the creative deployment of digital media recently released Pockets of Potential (Shuler, 2009), a study documenting the untapped potential of mobile learning. While the report focused on numerous platforms, it highlighted the iPhone and iPod Touch as having strong promise for children's mobile learning. Since Pockets of Potential was published, the App market has continued to grow rapidly. On April 23rd, 2009, the one-billionth App was downloaded from Apple's revolutionary iTunes App Store (Apple, 2009). This monumental App was downloaded by Connor Mulcahey, a 13-year-old boy from Weston Connecticut. Along with Connor, over 85 million iPhone and iPod touch owners have contributed to this massive influx of downloads, making iTunes a primary market for downloadable games and applications. Although the primary App consumer is likely an adult, perhaps the fact that a 13 year-old boy downloaded the one-billionth App is a telling indication of what's to come.

Over the past six months, Nickelodeon, PBS Kids Sprout and Disney have all entered the App market that is pegged to generate more than US$1.2 billion in 2009 (Rusak, 2009), and the preschool-oriented 'Wheels on the Bus' has been the top paid education App for months. With more than 21,000 games available for the iPhone and iPod touch compared with only hundreds on the DS and PSP (Tabuchi, 2009), it is not surprising that kids developers are taking this platform very seriously. The growth of children's Apps may be counterintuitive, as it is fair to assume that most young children currently do not own their own iPhone, or even iPod Touch. However, anecdotally it is very common to observe what some call the "pass-back" effect, where a parent or adult passes their own device to a child. Parents' phones have always been among children's favorite "toys", and as mobile devices become more functional for adults, they simultaneously become more appealing to kids.

Mainstream news and industry sources such as The New York Times and Kidscreen Magazine have been documenting this trend. Though these sources provide informal descriptions of what is available for children in the iTunes App store, none have done a systematic analysis with a focus on educational content. This report is a content analysis of the App Store's education section. It provides an up-to-date, independent, unbiased analysis, and provides a benchmark for following iTunes continued growth and evolution.

METHODS
A content analysis was conducted to analyze the educational category of the iTunes App store. The methodology for this analysis involved two key steps.

1. In late June 2009, the Cooney Center compiled a database of the 100 top-selling paid Apps in the education section of the iTunes App store. This database does not assess the quality or effectiveness of any specific product, nor does it represent an exhaustive list of every product available. Rather, it provides a basis for analyzing the kinds of educational products available and popular in the mass market.
2. All apps in the database were coded for the following characteristics:
    1. **Age**: This characteristic answers the question "What age is this App's target user?" Target age group was determined by reading the App description, which often explicitly noted a target age. If a target age was not explicitly noted, the judge used other features such as App description, features and image to determine target age. Apps could be tagged for more than one age group (for instance one App could target both elementary and middle school age children).
    2. **Subject**: This characteristic answers the question "What subject does this App aim to teach?" Subject was often explicitly stated in the App description. If a subject was not explicitly noted, the judge used

other features such as App description, features and image to determine subject. Apps could be tagged for only one subject.

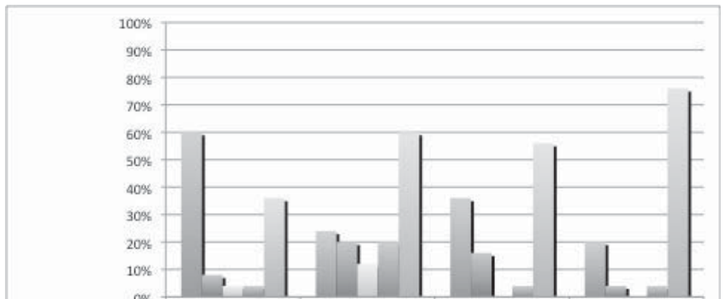
3. **Price**: This characteristic answers the question "How much does this App sell for?" Price was always explicitly noted, and list price (not sale price) was recorded.

RESULTS & DISCUSSION

Age

- **There is a significant market for children's educational Apps**

  Children's content makes up a significant proportion of the 100 top selling Apps (figure 1). Nearly half (47%) of the top 100-selling Apps target preschool or elementary aged children. The analysis becomes even more interesting when target age is analyzed by App rank. 60% of the top 25 Apps target toddler/preschool children – almost double the number that target adults (36%). The prominence of youth-targeted Apps is striking, and thus the market for children's educational Apps should be considered an important one.



	1 to 25	26 to 50	51 to 75	76 to 100
Toddler/ Preschool	60%	24%	36%	20%
Elementary	8%	20%	16%	4%
Middle School	4%	12%	0%	0%
High School	4%	20%	4%	4%
Adult	36%	60%	56%	76%

Figure 1. Target Age by App Ranking (N=100)

**Percentages add up to more than 100% because each App could be tagged for more than one age group.*

- **Toddler/preschool apps are more prominent than those for older children**

  Among experts on quality media programming for youth, there is a long-standing concern that educational television offerings for elementary and middle school children pale in comparison to offerings for their younger counterparts. Though this analysis did not assess quality, simply in terms of quantity, it appears that this trend also holds in the iTunes App Store. As indicated in Figure 2, 35% of the top paid educational Apps target preschool children, as opposed to only 12% and 4% targeting elementary and middle school students respectively.

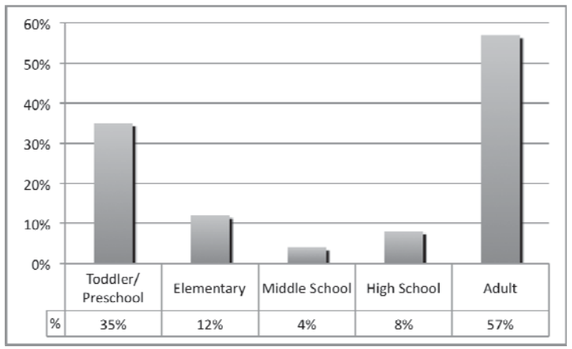


Figure 2. Target Age (N=100)

Subject

- **The top educational apps cover a variety of different subjects, with foreign language and literacy being the most popular categories**

  Apps are available in a variety of different subjects, including: Foreign language, literacy, general early learning, math, test prep, learning tools, creativity, astronomy, IQ, geography, quotes, sign language, animals, and other. Foreign language and literacy are the most popular subjects overall, however, other topics including general early learning, math and test prep are also amongst the most popular subjects in the top 25 ranked apps, supporting the conclusion that children's educational Apps is an important market.

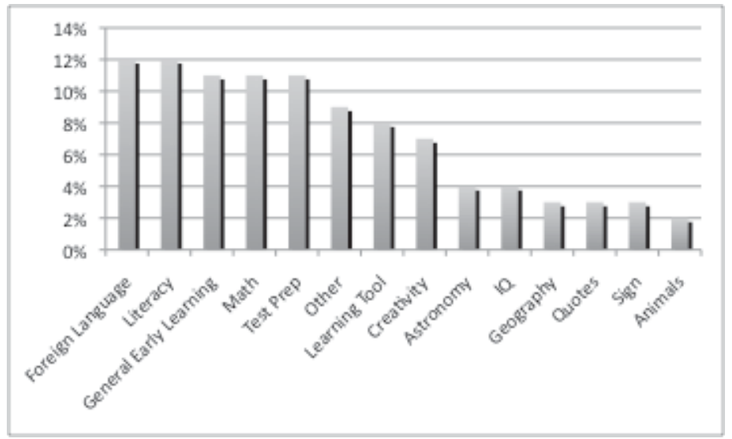


Figure 3. Subject (N=100)

Price

- **Children's Apps are significantly cheaper than adult-targeted Apps.**

  As indicated in Table 1, child-targeted Apps are significantly cheaper then those targeting adults, with most child Apps being priced at $0.99. The weighted average price for a child's App is $1.14, as compared to $5.77 for adults. Furthermore, the top 100 selling apps range from 0.99 - $149.99, however no child-targeted app exceeds $2.99. From this analysis it was not possible to discern whether there are fewer expensive children's Apps offered at the higher price points, or if there are Apps available that are not being purchased. Regardless, it is reasonable to conclude that higher-priced educational Apps for children could be an underserved market, presenting an opportunity for producers of high-quality, entertaining and educational Apps.

	Child (N=51)	Adult (N=59)
$ 0.99	88%	47%
$ 1.99	10%	8%
$ 2.99	2%	8%
$ 4.99	0%	17%
$ 5.99	0%	3%
$ 7.99	0%	5%
$ 9.99	0%	7%
$ 11.99	0%	2%
$ 149.99	0%	2%

Table 1. Price by Age Group

CONCLUSIONS

It is striking that such a significant proportion of the top-selling paid Apps are child-focused, particularly considering that children are not a primary market for either the iPhone or iPod Touch devices. In the Joan Ganz Cooney Center's recent report, Pockets of Potential, we argued that mobile devices have significant potential to be a key ally in supporting learning experiences. While gaming devices such as Nintendo's DSi still command the bulk of attention when it comes to kids and all things mobile, this short paper makes it clear Apps are unquestionably a new medium for providing educational content to children nationwide, both in terms of their availability and popularity.

Below are high-level recommendations to help Apps become a dynamic force for children's learning:

- Producers should develop Apps that take advantage of the unique affordances of the iPhone and iPod Touch. Currently, many of the Apps available are simply 'mini' versions of what one might find on a larger

screen like a computer, however it is ineffective to take educational applications that have been developed for a big screen and simply shrink them down to be used on mobile devices (see Pockets of Potential for a fuller discussion). Developers need to discern what is special about the iPhone and iPod Touch devices and design interventions that take advantage of those attributes.

- The academic community should pay attention to Apps as an important potential factor in children's mobile learning. Researchers should investigate the implications of the current environment, and recognize "what works" in educating children through Apps. These learnings should be disseminated to industry.
- Policy-makers should work with Apple and other mobile industry leaders to engage in consumer protection initiatives to ensure that educational claims are accurate. The children's digital media market is replete with products that advertise unsubstantiated educational claims (Shuler, 2007). iTunes currently risks reinforcing this practice as there is currently no way for parents or children to tell if an App is truly educational, or simply marketed as such. If Apps are to be a new medium for learning, industry standards should be established around marketing products to children.
- Parent magazines, websites and watchdog groups such as Common Sense Media, Consumer Reports' and Parent's Choice should monitor this growing industry to provide consumer information and guidance.

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Harnessing Mobile Devices to Connect Learning in Formal and Informal Settings: the Role of Digital Narratives and Discontinuous Text Production for Meaning-Making

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ABSTRACT

This paper examines the affordances of mobile devices to produce digital narratives at the interface between learning in formal, institutionalised, and informal, self-directed settings. We discuss how learning experiences with mobile devices around digital storytelling might be brought into a fruitful relationship with institution-based learning. We argue that digital narratives – as an instantiation of mobile learning – can be seen not only to meet the requirements of traditional learning environments, but also allow for the creation of individualised meaning-making by using and creating learning episodes. We focus on, and outline a mode of storytelling, which we consider to be contemporary: the mode of discontinuous and multimodal text creation.

Author Keywords

Learning in formal and informal settings, digital narratives and storytelling, discontinuous text production, meaning-making

MOBILE DEVICES

Mobile devices have become more and more embedded in the life-worlds of users: they have become normalized in everyday life. Because of the degree of integration they have achieved, they can be considered as important cultural resources; resources, which embody social values and carry ideological baggage (Bruce and Hogan, 1998), and resources which are governed by social structures, cultural practices and user agency (Pachler et al., forthcoming). Mobile devices are attractive to us from an educational perspective given the affordances they provide for meaning-making, for engagement with, and for mediating the world around us as well as for communicating with it (Kress and Pachler, 2007). What is particularly striking, we find, is their increasing portability, functional convergence and connectivity, which affords a potential for social interactivity, ubiquitous information retrieval, processing and exchange as well as context sensitivity and location awareness. And, there is a noticeable trend in the reduction of cost of hardware and services, as well as in personal ownership and attendant familiarity with, and personalization of them. Related to this trend is an increasing level of expertise of young people in mobile device use in the context of their participation in mass communication and their media use.

DEFINITION OF MOBILE LEARNING

What, if anything, does the prefix 'm' or 'mobile' signify when used with 'learning'? Are we seeing a new form of learning emerge? We take the view that 'mobile' learning, or for that matter 'e' learning or 'ubiquitous' learning etc., do not point to a different kind of learning but, instead, to different conditions and environments of learning (Kress and Pachler, 2007).

The characteristics of mobile devices outlined above are new, certainly in their convergence in small, portable devices that have transcended traditional socio-cultural boundaries of acceptability in terms of technology use and penetration of private and public spheres: the devices are in the user's hands or on his/her person nearly everywhere s/he goes, day and night, and they are instantaneously 'offable and onable' to quote a cult British electricity advert from the late 1980s (Creature Comforts, Nick Park; see http://www.youtube.com/watch?v=Zv2tdCEBkKg).

Definitions of mobile learning abound. Sadly, they are often reductive in nature and foreground the delivery of content to mobile devices in small, micro-units. We do not subscribe to productivity-orientated and transmission-based notions of mobile learning. Instead, we see mobile learning as concerning the processes of coming to know, and of being able to operate successfully in, and across, new and ever changing contexts and learning spaces with and through the use of mobile devices. And, we consider it as being about understanding, and knowing how to utilize our everyday life-worlds as learning spaces. Therefore, from our perspective mobile learning is not primarily about technology (Pachler et al., 2009). Instead, we focus on the process of meaning-making, particularly in the context of media use in everyday life, in semiotic terms between the making of signs and the making of concepts. User-generated content and contexts are two

significant dimensions of the mobilization of mass media for us. Both are the result of semiotic work: that is, purposive work with meaning resources (Kress and Pachler, 2007).

NARRATIVES: FORMS AND FUNCTIONS FOR LEISURE TIME AND LEARNING

Narratives as a cultural phenomenon are part of everyday life as well as of formal learning contexts. A narrative is a construct describing a sequence of events and constitutes an important manifestation of human communication, learning and entertainment. If viewed as communication, narratives can be seen to be governed by the rules of semiotics, which have been developed to explain how meaning is made. If viewed from the point of view of learning and entertainment, explanatory frames drawn from literary theory, culture and media studies become relevant, which help determine the literary and artistic qualities of texts inter alia through structural analysis of the constituent parts, their functions and relationships (see also http://en.wikipedia.org/wiki/Narrative). Narratives prevalent in everyday life mostly have entertaining and sometimes also educational character. There is a fine line between entertainment and learning in every day life. Unclear boundaries between learning and entertainment also exist in schools.

NARRATIVES AND PARTICIPATORY MEANING-MAKING

Viewed from a perspective of meaning-making, narrative can be seen to function as an aid for making sense of everyday experiences and learn how to 'be' in particular contexts (Polkinghorne, 1988), as a tool to conceptualise through communication, dialogue and social practice as well as a 'vehicle to fashion identities' (Bamberg, 2004). We view narratives as a dynamic, experiential phenomenon, a lived process of meaning-making by which that which is known is reconfigured as is how it fits into existing conceptual frames. In the context of mobile digital technologies we also see narratives as inextricably linked with the appropriation of such devices and how they are harnessed for meaning-making through new cultural practices (Pachler and Daly, 2009).

Digital technologies feature a vast array of examples on how different media and modes can, and are being used to produce meaningful content and information in narrative form. The intentions behind the production of this material, the thematic interests as well as the intended addressees differ widely. What tends to be common is a certain sense of agency of the originator and the fact that it is underpinned by a clear notion of production of, as well as performance and participation in discourses and social practices. The commonality across these stories can be seen to adhere to certain 'rules' governing the relationship between the self and narrative. Bamberg (2006) argues that there are three levels from where value orientations can enter life-stories:

- a general level of culturally shared value assumptions that are deeply engrained in the cultural symbolic system that is employed when engaging in biographic work;
- my visions, hopes and aspirations about what I expect my future to be like (which also are culturally constrained, but nevertheless very personal and individual); and
- the kinds of situative, and local interactive forces within which the biographer finds him-/herself – in which we have to tailor our biographies toward our audiences.

In this way, the organisation and representation of information in narrative form is a communicative act of an individual or a group, it is about the expression of self and it is about meaning-making through engagement in social and cultural practices. Storytelling is used to express memories, fantasies, facts, desires, and success-stories, whatever can be imagined. These stories are meaningful to the people who created them: they want to report about an issue that is relevant to them, and they do it in different ways: associatively, maybe triggered or supported by images (maybe because they think they have a valuable perspective on a topic in hand); as reflection, by remembering a situation and describing it (maybe because of a particular experience they want to share with other people); as instruction, by giving advice and guidance on how (not) to do things (maybe because they had a particularly good/bad experience they wish others to make/avoid making). With mobile phones and live streaming on the internet, narratives can be told in real-time.

THE POTENTIAL OF NON-LINEAR AND DISCONTINUOUS MULTIMODAL AND MULTIMEDIA NARRATIVES FOR LEARNING

In literature, 'stream of consciousness' has become a popular stylistic device to express the (anti)hero's direct, i.e. unreflected, spontaneous and situative impressions, feelings, thoughts etc., as well as to keep them separate from any reflection and judgement elsewhere within the text. Syntax and punctuation are largely missing, and it is difficult at times to track the stream. This approach also points to an individualised perspective on the world, with the (anti)hero at the centre. Readers are not provided with an objective reading of, or advice on how to 'read' the text; they have to try to understand the (anti)hero and his/her view of the world in order to be able to make sense of, and meaning from the stream of consciousness. In many ways, we see similarities to the characteristics of digital narratives created and viewed with mobile devices: transferred to Western society of the 21st century, the stylistic device can be seen to be turning into a synonym for meaning-making in a society characterised by individualisation, consumption as well as information and knowledge production (see e.g. Pachler et al., forthcoming). Yet, information and knowledge cannot just be 'consumed' but have to be filtered and transformed in (individually) meaningful ways. From an educational perspective, the risk for learners or, in our terminology, meaning-makers is to fail in these construction processes, as individuals or as part of society or any other group or institution (see e.g. Schweizer, 2007). Therefore, we deem it an important role for school to scaffold the learners' individualised view to the world, their 'stream of consciousness' within existing structures, and to provide tools and 'navigational aids' (Kress, 2008, p. 346) to support them in their meaning-making and learning processes. School, in our view, has a role to play in mediating, 'translating' and 'objectivising' where tensions and uncertainties emerge; also because – as Jacucci et al. (2007) note – "the difficulty is that we can experience only our own life, what is received by our own consciousness and we can never know completely another's experiences". In the same way 'experience' is individualised, so is 'meaning'. Mediation and translation of (individualised) meanings can be scaffolded (for the concept of scaffolding, see e.g. Van Der Stuyf, 2002) with multimedia and multimodal tools such as social networking applications or mobile devices because they can be used for 'creating expressions' (i.e. representations, performances, objectification, and texts) and "to record and share experiences" (Jacucci et al., 2007).

Mobile devices can be, and are being used as tools in the meaning-making process to organise experiences, and to share them with others. One example is the case of Cyril (Pachler et al., forthcoming; Bachmair et al., 2009), who uses his 'native expertise' in the use of his mobile phone to make a video in which he reflects critically on the world around him. He shares his reflections with the wider world by making use of the functional convergence of new media by uploading his video onto an internet-based media platform. By capturing his personal interaction and engagement with the world in this way, he renders it visible and also makes it accessible to school-based learning.

DISCONTINUITY AS A CULTURAL AND TEXTUAL PHENOMENON AND ITS IMPLICATIONS FOR EDUCATION

We also argue here that the notion of discontinuity has a key function in the reading and production of contemporary texts (text for us is not only written or spoken text, but also media, modes, genres, and – referring to Fiske (2002) – any other material, object or concept available etc.) as well as in meaning-making and learning processes, especially with mobile multimedia and multimodal devices. We view discontinuity as a cultural phenomenon that is particularly prevalent in the media and to have considerable implications for cultural practices such as learning, particularly in the context of mobile device use. Invariably, due to limited space, we are only able to deal with the phenomenon briefly here and in relation to text structures and agency. Discontinuity we consider to be a certain break in consistency not only in sequencing and time line but also in aspects such as (distributed) authors, plot, and mainly in location of resources etc.

The understanding of modes, which schools consider to possess relevance for learning, has developed over centuries. With relation to narratives, the mode of the written text is still dominant. However, narratives are a cultural phenomenon that develops in line with technological innovation. With the use of this format in different media and in different modes, we distinguish narratives on a structural level in terms of linearity (continuous texts such as novels[i]) and non-linearity (discontinuous texts such as websites, multimedia arrangements and multimodal representations). Given the characteristics of mobile devices, e.g. display size, their constraints on inputting text, as well as the possibility to distribute different text modes on different platforms such as Twitter, Facebook, AudioBoo, etc., we see discontinuity as a particular issue in mobile learning.

Klastrup (2007) sees "'storytelling' (used here synonymously with 'narration') as the structured and mediated presentation of experience(s) with a recognisable beginning and end". Consequently, "'mobile storytelling' is defined as the structured and shared presentation of visual material produced with a mobile device, supplemented by text and/or music or sound". Additionally, she refers to the relevance of presentation and structures for the meaning-making process: "Meaning is dependent on the presentation of the story and the structure i.e. the choice of sequence."

Discontinuous text structures find their reflection in discontinuous text reading. 'Multi-tasking', for example, is an attendant pattern of media use that combines activities such as communication in a chat on Facebook whilst listening to music and doing one's homework (Moser, 2008, p. 290). Cultural pessimists might argue that in this example learning is backgrounded in favour of (unreflected and leisure-dominated) media consumption. We do not wish to make a value judgement here but, instead, want to note that from a pedagogical perspective it is necessary to scaffold such patterns of use to enable pupils to learn in such 'busy', media-rich environments. Multi-tasking requires learners to structure the information, which is around them or to organise their social lives; or, put differently, to transform discontinuity into (subjective or objective meaningful) continuity. This structuring has the aim of getting to the core of the respective activity (Moser, 2008, p. 290). Other examples of reading discontinuous texts are 'zapping', i.e. switching through TV channels in search of an interesting programme, or clicking through hyperlinks. Cross-media formats, for example Pop Idol, can also be seen as discontinuous texts, which have to be constructed into a consistent stream (Bachmair et al., 2008, p. 252; Bachmair 2006a and 2006b). Participation in current cultural practices in everyday life, therefore, requires an ability to engage meaningfully with discontinuous texts.

In view of the increasing prevalence of these forms of discontinuous text in the life-worlds of learners through their media use, we believe that schools have to take seriously such new forms of literacy characterised by discontinuous, non-linear 'texts'. We would emphasise the myriad of possibilities to connect and sequence (blocks of) text(s) into meaningful wholes and we consider even closed texts to lend themselves to becoming building blocks for new narratives. Narratives, thus, can be seen as 'form', as expression for the purpose of meaning-making by using continuous and discontinuous text, with multiple media, as well as with multiple modes. In the meaning-making process, (dis)continuous texts are assembled, in different media, with different modes, to a more or less linear learning trail (for learning trails see e.g. Walker, 2006) that allows objectifying knowledge in a meaningful way for others.

MULTIMEDIA AND MULTIOMODAL MEDIA – CONVERGENCE AND MOBILE MEDIA

As our focus in this paper is on meaning-making, we focus mainly on the construction and production of narratives to learn to read or write or any other curricular learning outcome here. We are particularly interested in mobile phones as convergent multimedia and multimodal tools for pupils in their meaning-making and the organisation of discontinuous texts. And, we are interested in how schools can provide opportunities for pupils to organise their narratives and make them relevant for their formal learning. We argue that pupils are experts in meaning-making with new technologies and that schools need to consider ways of harnessing this expertise and allow pupils to contribute their knowledge and make it available to others (Seipold, 2008), not least as it is likely to be motivating for them.

In Pachler, Bachmair and Cook (2009), we propose the following ways in which schools can assimilate learning taking place in informal contexts into formal educational settings:

- through the recognition of the 'native expertise' of learners in relation to mobile device use and
- through user-generated mobile contexts.

We argue that assimilation can be fostered

- through building on conversational threads from learners' life-worlds as well as
- through the docking of formal educational learning situations onto contexts of personal development and learning around the use of mobile devices in learners' everyday lives.

Convergence plays a key role in the process of meaning-making as it is considered to be essential for seamless transitions and working without technological obstacles, which might reduce the use of multiple technologies or multimedia. Convergence impacts not only on the seamless transitions at a technological level, but also on mobility in different ways. Kalkbrenner and Dietrich (2008, p. 254) define technological mobility as basic requirement for other kinds of mobilities: 'mobility of technology' (compatibility between technologies), 'mobility in space' (mobility in physical space), 'mobility in didactic structures' (switching between teaching concepts), 'mobility of roles' (teachers become students and vice versa) (Kalkbrenner and Dietrich, 2008, p. 254). At an activity level, "mobile (communication) devices can bring together what belongs together in a rich learning environment: ***acting*** in the physical world (classrooms, outdoors), ***accessing*** symbolic resources (text, sound, video on the Internet), and ***interacting*** with others. We see this overall convergence taking place along three dimensions: technology, collaboration, and curriculum" (Mann et al., 2007). Mobile devices are seen as 'mediation tools' between places, resources and activities, both, formal and informal.

CONCLUSIONS

In this paper, with reference to some theoretical underpinnings, we explored the potential of mobile phones for learning across formal and informal settings. We proposed a view of narratives as participative meaning-making and explored its relationship and potential for learning. In particular, we examined some defining characteristics of narratives in the context of social networking, namely their multimedia and multimodal nature as well as their inherent discontinuity, and we discussed the implications for the reading and production of such texts. We noted that discontinuous and multimodal texts are not a new phenomenon, but that their importance in everyday literacy practices is growing. What is new is that students now possess the mobile devices, and are developing cultural practices around them in everyday life, which allow them to record their experiences and view of the world and to produce, or to access (multimodal) objects and cultural artefacts within and outside of school. This poses challenges for schools in terms of the need for a realignment of certain traditional cultural practices of learning; we tried to exemplify how these practices might be adapted in line with changing cultural practices in everyday life.

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[i] We are aware, of course, that novels, and other linear texts, can feature breaks in linearity, which are often deliberate and tend to have a stylistic function.

Ontology Based Content Management in a Mobilized Learning Environment

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ABSTRACT
This paper describes the STUDIO ontology based content authoring system, developed according to the challenges emerging from Bologna process deployment in Hungary. Considering the needs of Hungarian academic sector, mobility of learners has also been treated as a key requirement. This system has several fundamental components: an Educational Ontology – which also serves as the domain of curricula development –, a content developer, a content repository and an adaptive knowledge testing engine with a test bank. The services and learning objects are distributed towards the students through a mobilized Learning Management System.

Author Keywords
ontologies, higher education, mLearning, blended learning, learning infrastructure

INTRODUCTION

One of the main objectives of current European higher education reforms is the introduction of a common framework of transparent and comparable degrees that ensures the recognition of knowledge and qualifications of citizens all across the European Union. Clearly, measuring knowledge of students in a reliable and objective way is a cornerstone in the implementation of the common framework. Such comprehensive learning environments should be developed that can provide help not only in the acquisition of knowledge, but also in the evaluation of the already acquired knowledge and putting emphasize on mobile accessibility. Main research question behind our STUDIO system development project is how a mobilized ontology-based adaptive knowledge testing system can be implemented and applied in higher education.

BACKGROUND

Being mobile while studying is not a new idea. It has been incorporated into teaching activities and official curricula a long time ago in the form of field trips and on-spot trainings. Distance learning always carried features of mobility. According to Desmond Keegan (Keegan 1990), distinguishing characteristics of distance education include the:

- Separation of the teacher from the learner(s)
- Use of technical media supporting communication and collaboration among students
- and their teachers;

The appearance of mobile technology in education in the mid 1990s has extended the scope of teaching and leaded us into a new world of education. Mobility in learning, supported by the latest information and communication technologies (ICT), has become an essential need for both the new generations of students and educational institutions (Naismith and Corlett 2006). In order to suit all requirements it is not enough to simply 'mobilize' the ordinary learning environments (Walker 2006), but conflicts of informal learning and Face-to-Face (F2F) education also have to be eliminated (Sharples 2006). Integration of mobile devices into education also fosters inclusion of innovative educational practices (Hoppe 2006; Milrad 2006).

MOBILE LEARNING AND HIGHER EDUCATION

In 2006 a Hungarian national project has been launched under a governmental program aiming to modernize the structure of the Hungarian higher education through redefining its processes (institutional and operational processes, academic processes and supporting innovative processes). The final research output was a major milestone in the reform of the Hungarian higher educational sector (Gábor 2006).

This project also concentrates on innovative technologies, which scaffold the academic performance of universities. Among these technologies, mLearning was mentioned as a key instrument of educational technology in the near future. The idea of using handheld devices in education provides flexibility, spare time and increase work efficiency. Furthermore with the 3rd generation mobile (UMTS) network and the latest mobile devices it is possible to develop an efficient mobilized distance learning system, which delivers multimedia rich learning. Therefore the research output also emphasizes the importance of implementing mobile learning technologies in the following main institutional activities (HEFOP FOI Project 2006):

- Administrational processes

  Educational institutions are advised to use mobile communication technologies to contact students regarding administrational issues. This technique should also substitute costly and slow postal services, especially in distance education.

- Educational processes

  There is visible demand from students for learning anytime, anywhere. To meet this demand, educational institutions should design courses considering possibilities of learning object mobilization. Therefore they should offer access to educational infrastructure for mobile devices, which enables instructional designers to implement courses (mobilize content) for mobile learners.

On the foundation of educational modernization projects CUB identified several focal points where the ontology based learning environment and mobile learning can work together successfully:

- Mobile learning has a broad and well developed infrastructure. There were 119.1 mobile telecommunication service subscriptions per 100 people in November 2008 (National Communication Authority 2009) providing valid infrastructure for learning content delivery.
- Students needed more flexibility in their learning.
- Students are early adopters of technology, especially mobile technology. Universities can reach and involve them better in academic programs, using mobile technology.
- Early adoption of learning technology provides competitive advantage on the educational market of higher education institutions.

At the same time the above mentioned transition has its institutional limitations. In traditional educational institutions, just like in the Corvinus University of Budapest, learning technology should be an integral part of knowledge transfer between students and lecturers, but it cannot be the only platform of teaching. However it is essential to follow up students' demand – which forces institutions to involve technology more and more in their everyday teaching activities, enabling students to be flexible in their learning – and construct F2F based learning platforms, which provide elasticity in course content development and delivery. To meet challenges, emerging from combining ICT enhanced learning and traditional classroom education, a blended service framework has been elaborated. This service portfolio designed by the educators of Corvinus also put an effort on incorporating theories of navigationism (Brown 2006) and connectivism (Siemens 2005).

The core element of the portfolio is the F2F education. The scope of curricula taught in our training programs is represented by the recently developed educational ontology, which is described in the next sections. On the top of traditional classroom teaching a Hungarian, mobilised Learning Management System (mLMS - CooSpace) provides authentication and supports individual learning, enabling the use of rather different, independent learning styles. Supplementary modules, like our ontology driven content authoring environment (STUDIO), are connected to this platform as well.

The primary objective of our approach is to provide support in exploring missing knowledge areas of students facilitated by an adaptive knowledge testing and evaluating system in order to help them to complement their educational deficiencies. The ontology of curricula, the so called Educational Ontology, provides the fundamentals of this approach. In our solution the exact determination or estimation of the knowledge level is not an objective. The emphasis, which was also taken into consideration when the model of the ontology was formed, is on detailed exploration of missing knowledge areas and on discovering each knowledge area where the candidate lacks acquaintance.

ONTOLOGY BASED CONTENT DEVELOPMENT

Curriculum content may come in many forms and formats, from different departments, with different internal structures and even in different languages. Ontology-based approach provides support for capturing regularities in a single framework, general enough to model the curriculum content management requirements of multiple institutions.

Content in the STUDIO system consists of the following elements:

- the ontology itself
- questions for the concepts in the ontology
- learning objects describing the concepts in the ontology

Content creation begins with the development of the ontology, as it was elucidated in the previous sections. This step provides the basis for all other content authoring activities. The created ontology has to be deployed into the Studio system in order to be able to associate questions and learning objects to its concepts.

The model of the Educational ontology has been developed by Vas (Vas 2007). This model was eventually developed for the Department of Information Systems at the Corvinus University of Budapest (DIS) and tested on students taking an Information Management BSc course.

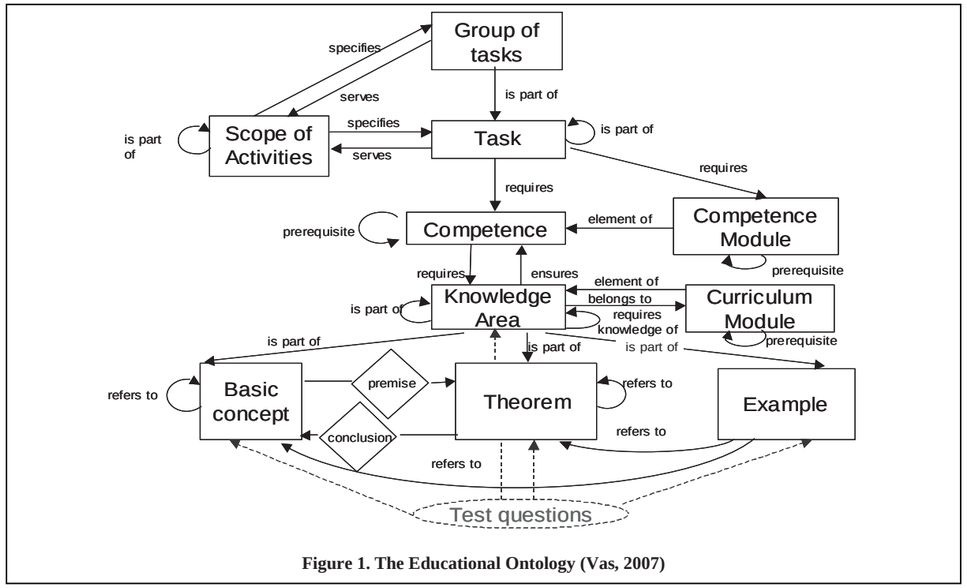

Figure 1. The Educational Ontology (Vas, 2007)

The scope of curricula taught in the Business Informatics training program of (DIS) is broad and curricula in a general are substantively different in nature, which clearly poses a challenge on the ontology model building process in this domain. It should be also taken into consideration that the structure and content of a subject might be at least partly different in different institutions. Major classes of the ontology that were developed in the first cycle should meet these challenges. Taking all these into consideration the model of Educational Ontology is depicted by Figure 1.

"Scope of Activities" Class

The "Scope of Activities" class contains all of those professions and activities that can be successfully performed with the acquisition of those competencies that are provided by the given training program.

"Task" and "Competence" Class

A job consists of numerous tasks that should be executed in the course of everyday work. At the same time the employee must possess certain competences to be able to accomplish tasks relating to her position. So each task should be in a "requires" relation with competences. On the other hand one scope of activities should be directly "specified by" or "served by"-- its relation with tasks. This way the given scope of activities prescribes a number of concrete tasks that will define concretely required competences.

"Group of Task" and "Competence Module" Class

By defining separate classes for tasks and competences, not sets (competence modules, group of tasks), but their elements are connected to each other. At the same time the "Group of Tasks" and the "Competence Module" classes should be entered to the model to enable the definition of sets of tasks and competences as well so that further ways of comparison may be ensured.

"Knowledge Area" Class

Knowledge Areas (KA) and competences are connected directly with the "requires" and "ensures" connection. (A competence requires the knowledge of a given knowledge area and the good command of a knowledge area ensures the existence of certain competence(s).) The class of "Knowledge Area" is an intersection of the ontology, where the model can be divided into two parts: One part of the model describes the relation of knowledge areas and labour market requirements with the help of the above-described elements and the other part will depict the internal structure of knowledge areas. The concept of the "Knowledge Area" is at the very heart of the ontology, representing major parts of a given curriculum (Job related training program). Each "Knowledge Area" may have several Sub-Knowledge-Areas through the "is part of" relation". Not only the internal relations, but relations connecting different knowledge areas are important regarding knowledge testing, too. This is described by the "is part of" relation. At the same time another relation has to be introduced, namely the "requires knowledge of" relation. This relation will have an essential role in

supporting adaptive testing. If in the course of testing it is revealed that the applicant has severe deficiencies on a given knowledge area, then it is possible to put questions on those areas that must be learnt in advance.

Assessment Engine

In order to provide adequate support by the Selection Ontology for the adaptive testing system several theoretical foundations and conceptions must be laid down in this model concerning the test bank. One pillar of the testing system is the set of test questions. Accordingly all test questions must have the following characteristics:

- All questions must be connected to one and to only one knowledge element or knowledge area. On the other hand a knowledge element or knowledge area may have more than one test question. This way the Test Engine is structured by the Ontology.
- All questions should be weighted according to their difficulty.
- Test questions will be provided in the form of multiple-choice questions. Therefore parts of a question are the followings: Question, Correct answer, False answers

The test engine and the repository do not form an integral part of the ontology. This means that questions do not have to form a part of the ontology if we want to represent correctly a given job. That is the very reason for connecting the Test engine to other elements of the ontology with dashed lines (Figure 1).

The Test Item Editor is used to build up questions for appropriate concepts in a particular ontology. These questions are stored in the Test Bank and queried by the Adaptive Test Engine in order to generate tests. The system supports multiple choice questions with any number of possible replies and one correct answer. The author has to mark the right answer in order to allow the adaptive test system to evaluate the answers. It is advisable to associate several questions to an ontology concept; however the system only verifies the existence of at least one question per node. The Test Item Editor guides the author through the plot of ontology concepts by representing them in a tree-shape. This function also provides support for discovering conceptions without questions attached.

Developing and representing textual and multimedia content is enabled by the Semantic MediaWiki platform. The linkage to an ontology was described in the previous section. Following the ontology import, authors can insert learning objects in the system collaboratively by using MediaWiki features. These elements of content are stored in the repository, in conjunction with appropriate version information that enables authors to follow up and review all changes made in the content. There should be at least one person in the authoring team who has an overview of the status and readiness of the LO(s), since independent authors are responsible only for their own parts. For the Wiki page authors a detailed data formatting and inclusion guideline has been created, with prewritten html codes. Even though the content developer doesn't possess relevant html knowledge, with a simply copy-paste mechanism it is possible to embed rich media content.

Students, who log in the system from a mobile phone, using the mobile interface of our LMS, can access and read the content, which is either in the MediaWiki or in a course related Mobile Learning Space. These learning spaces contain face to face course lecture notes, presentations or other additional learning materials. For some courses location based content is also available. Neither the mLMS nor the MediaWiki are capable to communicate with positioning systems. In order to facilitate location based teaching a flash based application has been developed, which must be downloaded from the Mobile Learning Space and installed locally on the handheld device in order to benefit from location sensitive content delivery.

All materials are accessible via the normal desktop PC interface. PDAs, smartphones with Wireless LAN function are capable to enter the LMS this way as well. In case using a mobile phone, it is possible that the browser won't be able to access our website. To avoid this problem we recommended students to use the Opera Mini, which is a free internet browser application for wide range of mobile devices. This Java based browser runs on almost all commonly used handhelds. Downloading instructions for the Opera Mini were provided through the mLMS as well.

RESULTS

The first trial of this ontology based adaptive testing and the mobile learning course content delivery was in the spring semester of 2007. Annually, more than 650 Business BSc students have to take Business Informatics as a compulsory course at the Corvinus University of Budapest. This program is a regular face-to-face program, meaning that knowledge transfer is initiated in classrooms. The trial mostly validated our efforts. Students were engaged, interested in using their handheld devices in education. The ontology based self assessment trial indicated, that students appreciate a testing system telling them their missing knowledge areas, which need to be practiced before the real exam. However there were negative feedbacks as well:

- Students demanded simple user interfaces. Content should be available fast and easy.
- Simplicity and clarity is also an issue in case of learning content. Learning objects delivered by mobile learning infrastructure, should be very straightforward, up-to the point. The story should always be more important than technology.

- Services (e.g. access using mobile networks) should be free, students don't want to take any costs

For a detailed analysis of the trial please consult our previous publication in IJMLO (Vas, Kovács, and Kismihók 2009).

CONCLUSIONS

The above discussed pilot research has focused on the application of electronic and mobile learning tools in the academic sector. As a result a competitive content authoring and knowledge evaluation system has been developed (STUDIO), which serves the needs of mobile learners and also promotes the transition between the BSc and MSc levels of higher education. This platform independent learning environment enables the development of customized qualification programs, based on the individual's previous qualifications, completed levels, corporate trainings and practical experiences. Subsequently the potential application areas of this approach are rather wide. Higher education is not the only one, who can enjoy its benefits, public and business sector are also possible targets. This architecture also enables content transfer for individual learning scenarios through traditional Web environment and mobilized learning spaces.

Ontologies, as an abstract and precise way of knowledge description were used to describe the curricula and the needs of the labor market (competencies) in the project. The mobilized learning environment creates flexible learning spaces, which supports individual formal and informal learning either on campus or in individual settings. This approach proved to be fruitful and we are going to extend the scope of this research to the wider academic and business community.

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Implementing a Mobile Learning Pilot with RSS: Lessons Learned and Users' Satisfaction

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ABSTRACT

This paper summarizes the objectives, methods and results from the first formal launch of a Mobile Learning program at a Fortune 500 software company. A pilot program was initiated to determine the viability and acceptance of a 'push' paradigm for training using Really Simple Syndication (RSS) to deliver courses to employees. User satisfaction with this method of receiving and consuming training was gathered via a survey. The results showed a high level of satisfaction and interest in Mobile Learning. The project also generated valuable lessons which can be applied to future projects.

Author Keywords

Mobile Learning Pilot; Really Simple Syndication; RSS Feeds; Push Paradigm for Training; Web 2.0; Audio MP3 Podcast; Video MP4 Vodcast; Project Management Body of Knowledge (PMBOK); Project Charter; vPortal

BACKGROUND

About the Technology

RSS (Really Simple Syndication) is a standardized format used on the web to publish frequently updated works, such as blogs, news headlines, audio or video. RSS documents called *feeds* are created in XML (eXtensible Markup Language), a language which uses simple text characters and tags to encode data such as the title, author and publishing date. A feed lists content on the website that is changed or new (Duffy, Bruns 2006).

RSS feeds are read using software called an *RSS reader*, *feed reader* or *aggregator*. The standard format of the RSS feed allows the information to be published once and viewed by many different programs. Typically a user subscribes to a feed by clicking an RSS icon in a browser or the website URL is copied to the RSS reader. The RSS reader checks the user's subscribed feeds regularly, downloads any updates that it finds, and provides a user interface to monitor and read the feeds (Wikipedia, n.d.). Web feeds benefit publishers by letting them syndicate content automatically. They benefit readers who want the ability to receive updates from the various website feeds without visiting each individual site.

A *podcast* is a series of digital media files that is released episodically and downloaded through web syndication. (The term "podcast" is a blend of the words "iPod" and "broadcast".) Like RSS readers, content management applications known as "podcatchers" automatically identify and download new files in the series, by accessing a centrally-maintained web feed that lists all files associated with that particular series (Wikipedia, n.d.). New files are automatically "pushed" to the user's computer for playback, or synchronized to a portable media player.

Video-on-demand podcasts (*vodcasts)* can also be received via subscription. Educational vodcasts can be a beneficial learning tool in the areas of corporate training, higher education, K-12 and personal enrichment (Lewis, 2006). Just like podcasts, updates on a vodcast feed can be collected and displayed by the podcatcher or aggregator software. Figure 1 shows the process of publishing and subscribing to a podcast or vodcast.

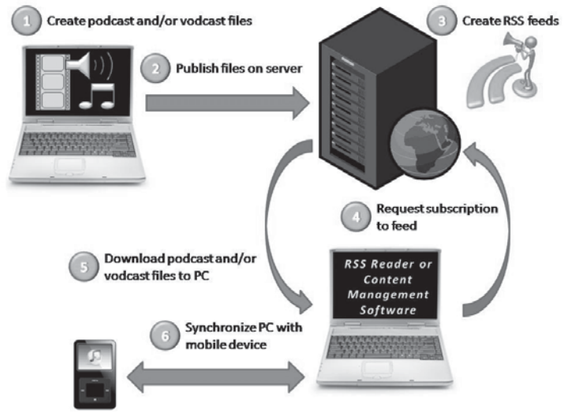

Figure 1. Steps to publish and subscribe to a pod- or vodcast.

Practical applications for RSS technology in education and preliminary measurements of user satisfaction have been researched and discussed in several articles, journals and conferences (Maag, 2006; Harrsch, 2003). Management at a Fortune 500 software company was interested in measuring user satisfaction and perceived value of a new training delivery paradigm: using RSS to "push" the latest available training to employees.

About the Project

The concept of Mobile Learning had been investigated by the Education Services department of the software company within the past two years. A limited number of audio-only courses designed for the sales team were available for mobile devices, but this initiative lacked a comprehensive communications strategy to announce it to employees. Lack of awareness resulted in limited uptake of the courses. About the same time, the company acquired a smaller organization with complementary products to its own. In the acquired company, Mobile Learning projects were in the planning and prototype stages, and had been rolled out to a limited extent. Neither of these efforts were formalized projects with specific objectives, deliverables and plans, and as a result, they failed to gain traction for Mobile Learning to become an accepted new training methodology. However, these projects did successfully confirm the proof of concept.

Historically, the managers in Education Services had been challenged to find ways to increase the usage of their training courses. The employees of the organization did not often have the luxury of time to proactively seek out new information to develop their skills and product knowledge. These managers saw the potential for using RSS to automatically deliver targeted Mobile Learning courses to employees based on their role, and decided to launch the initiative as formal pilot project. The pilot included a plan to gather formal metrics by surveying users. The user satisfaction data and feedback would be presented to senior management as business justification to expand the Mobile Learning program and continue the development of training for playback on mobile devices with delivery using RSS.

METHODS

The Mobile Learning Pilot was conducted using a project management methodology based on the Project Management Body of Knowledge (PMBOK) from the Project Management Institute (PMI). The decision to run the pilot as a formal project was crucial to the project's success. Gaining support from stakeholders and management was an important precursor to gathering the desired feedback. Stakeholders were individuals responsible for training Technical Support, Systems Engineering and Consulting personnel; their acceptance and participation in the project were necessary in order to engage participants from the target audiences.

At the initiation of the project, a Project Charter was created and approved by the project team. A *Project Charter* is a document which formally authorizes the project and includes the initial requirements that satisfy the stakeholder's needs and expectations (PMBOK, 2008). The creation of a Project Charter is a critical step when bringing together a diverse group of stakeholders each with their own priorities and agendas because it clearly defines the project, its objectives and commits the team to action. The Project Charter for the Mobile Learning Pilot also summarized the problems to address, high level requirements, scope of the work, risks and deliverables.

Other elements of the project management methodology included the creation of formal project plans, communications plans, risk management plans and testing plans. Also weekly team meetings were scheduled to review the project plan, upcoming activities, dates and commitments for deliverables. These meetings were essential to build cohesion among the team and maintain momentum of the project.

User satisfaction data was gathered via web-based forms using Metrics That Matter, a surveying and benchmarking application from KnowledgeAdvisors, Inc. The survey consisted of seven *Likert scale* questions; this type of question is typically used to measure the level of agreement with a statement or satisfaction with an item, feature or process. Two questions with Yes or No answers were also included, to determine whether respondents would recommend Mobile Learning to others and if they would be likely to take additional Mobile Learning courses. The survey also had five multiple choice questions for demographics and to determine the mobile devices and reader software used by the respondents. The conclusion of the survey included three open-ended comment areas to find out what the users liked best and least about the Mobile Learning Pilot, then one question for any additional comments. The survey took less than 4 minutes to complete, as measured with a pre-test before it was launched.

CONTRIBUTION

The Mobile Learning content was created by the client's Educational Media Services team. Due to the ambitious schedule for the pilot – completion and evaluation within 3 months – the project team decided to use training modules from their existing library of assets. A total of 27 modules from 12 courses were selected for the pilot. About half of the content was product-related, i.e., information about the client's software products, how to configure, manage and administer the software, etc. The remaining half of the material was related to identifying and qualifying sales opportunities, pitching solutions and best practices. The modules ranged from 11 to 57 minutes. The average duration of a module was 26 minutes.

The rich-media portal called *vPortal* from Altus Learning Systems was selected to host the content. This system features integrated RSS capability and Web 2.0 features such as blogs, communities, user-provided feedback via ratings and the ability for users to customize content. The raw video files were provided to the production team at Altus Learning Systems, who post-produced the files and prepared them for hosting on vPortal. The files were converted into a universal MP4 format which supported playback on a wide variety of mobile devices. The video files were also converted into audio (MP3) format.

Two and one-half months prior to the Mobile Learning Pilot, 48 training modules had been posted on vPortal and announced as a pilot initiative to test the acceptance and uptake of fully transcribed video-on-demand training with comprehensive text search capability. Downloads of MP3 and MP4 versions of the modules were available, but the RSS subscription feature was not activated until the Mobile Learning Pilot began.

With the launch of this pilot, a category of courses called "Mobile Learning" was created, under which sub-categories for three employee roles were created. Selecting one of the roles displayed only the courses appropriate for that role, which provided an easy way for users to locate the courses they needed. The vPortal system automatically created news, podcast and vodcast feeds for each subcategory. Users were free to subscribe to any or all of the feeds – they were not limited to their particular job function.

After subscribing to a feed, the audio or video training modules associated with that feed were automatically downloaded to the user's computer. Communications and announcements about the project emphasized ease of use and time savings. With RSS, users no longer had to seek out the training they wanted; now it would be automatically pushed to their systems and available for consumption at their convenience.

The duration of the pilot was four weeks. The user satisfaction survey was available during the pilot; access to it was removed at the end of the four week period.

EVALUATION

Although the pilot period was brief, the availability of Mobile Learning generated a great deal of interest, as evidenced by the number of users who visited (and re-visited) the vPortal system. During the four week pilot period, 346 people visited the system 676 times and downloaded 1,034 modules.

The activity for the four weeks of the Mobile Learning Pilot nearly doubled the rate measured during the two and one-half months prior to the launch and promotion of Mobile Learning on the vPortal system. The user activity statistics indicate that users are strongly interested in Mobile Learning and the benefits of using this new technology for training.

User Satisfaction Survey Results

Participation in the survey required the user to click a link from vPortal to enter the survey software; in retrospect, this was a flawed design because after the user subscribed to a feed, there was no reason to return to vPortal. Clearly the failure to make the survey an integral part of a feed led to fewer completed surveys than desired. To compensate for this error, emails were sent to all portal users containing a link to the survey and requesting their feedback.

The users who completed the survey (n=14) indicated a high level of satisfaction and shared many valuable comments. The statements to which the survey respondents were asked to indicate their level of agreement on a scale from 7 = Strongly Agree and 1 = Strongly Disagree are summarized in Table 1 below.

Statement	Average Rating
The instructions for setting up RSS feeds were helpful	5.23
The page to subscribe to RSS feeds was easy to use	5.08
The role-based categories for the Mobile Learning content are a good way to get the courses of interest to me	6.21
Viewing/playing the modules on my mobile device is a good way to learn	6.77
The length of the training was suitable for the Mobile Learning format	6.25
I think my job performance would improve if more training were available in the Mobile Learning format	6.64

Table 1. Results of the Likert Scale Questions from Mobile Learning User Satisfaction Survey.

When asked "Would you recommend others use the RSS feeds and Mobile Learning courses?" 93% of the survey respondents indicated "Yes". One hundred percent of the respondents answered "Yes" to the question, "Would you take more Mobile Learning courses if they were available?"

The comments gathered in the survey enabled the project team to gain valuable insight into how the target audience perceived Mobile Learning. When asked "What did you like *best* about the Mobile Learning Pilot?" the majority (57%) of the respondents indicated they liked the flexibility in learning and the ability to review content at their convenience.

Comments received in response to the question, "What did you like *least* about the Mobile Learning Pilot?" were also valuable. The project team uncovered opportunities to provide better instructions on how to subscribe to RSS feeds and synchronize with their mobile devices.

Finally, the users were asked to rate their overall satisfaction with Mobile Learning; the average of the responses was 5.43 on the 7-point scale.

REFLECTION

The success criteria defined at the beginning of the project were the on-time completion of project deliverables and the achievement of an overall satisfaction rating above 5.0 on a 7 point scale. Based on these criteria, the pilot was a success. However, the project can have a wider impact: the lessons learned from the rapid deployment of Mobile Learning with RSS can be valuable to other organizations and considered when planning future projects.

The pilot confirmed the appeal of Mobile Learning, but critical to a project's success (especially when introducing a new learning methodology in an established organization) is support from management, stakeholders and influencers. Without the support developed for this pilot, it would have been difficult to complete the project and engage individuals to visit the vPortal system and subscribe to the RSS feeds.

Project communication was also an important factor in getting user participation. The project team spent nearly as much time on project communications and announcements as with the preparation of the training content. Just building the system with RSS feeds would not be sufficient to launch a Mobile Learning program. Clear, effective and consistent communications are absolutely necessary in order to raise awareness, encourage users to participate in the program and take action to use the system. Background information about RSS and instructions on subscribing to feeds is also needed and an introductory demo video is being considered which will introduce new users to the concept of RSS.

One particular comment – "the content needs to be made with mobile learning in mind" – also supported a theory of one of the senior managers on the team: not all training material is suitable for Mobile Learning. The small size and resolution of the displays on mobile devices limit the content that would be useful to users. Very long sessions or complex, dense displays (such as a screenshot) may lead to eye strain and/or fatigue and diminish the impact of the training. The project team concluded that short, simple, easily-consumed materials are the best choices to garner the highest satisfaction among the users.

Finally, it would have been desirable to gather more feedback from users via the survey. Future projects should consider designing a method to easily access the survey, and an incentive for completing the survey such as a random drawing for a prize or small cash award would lead to more completed responses. Also a longer timeframe for the pilot would have allowed for more completed responses.

CONCLUSION

Development and Evaluation of a Support Tool for Time Management on Mobile Phone

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ABSTRACT

In this research work, a new support tool to promote students' self-regulated learning is developed and evaluated practically. In addition, a new tool is designed for face-to-face classes. The new tool has three main functions: (1) to display to-do lists and target times planned by the students, (2) to input and save the records of their study, and (3) to display the remaining time for studying according to their inputted records. The new tool was used and evaluated during a mathematics class at a women's university. The result of the analysis indicates a relationship between the students who referred to their plans and records and students who could acquire confidence. Finally, it is concluded that while the tool was not useful for all students, certain students adopted the new tool for supporting their self-regulation.

Author Keywords

self-regulated learning (SRL), mobile phone, study plan, study record, developmental education

INTRODUCTION

Numerous researchers have reported the importance of self-regulated learning. Pintrich (2004) introduced four assumptions of a self-regulated learning perspective; one of the assumptions was that learners can potentially monitor, control, and regulate certain aspects of their own cognition, motivation, and behavior as well as some features of their environments. However, particularly in the context of the developmental education, certain students have not developed their monitoring, controlling, and regulating skills for such aspects. In fact, Lay & Young (1998) reported that developmental and regular admission students significantly differed in the deployment of their self-regulatory strategies. In particular, time management is important for the students. Therefore, they require a support tool that enables them to become self-regulated learners. For example, Lee (2007) reported that participants who take LMS-based (Learning Management System) e-learning environment courses that provide time management strategy support showed greater improvement in the total variables of time management strategies and "daily planning" than the participants who took e-learning environment courses without support.

However, these tools or systems are specifically meant for e-learning systems; they have few applications with regard to face-to-face classes. In addition, these existing systems are based on computers. However, if the students study with textbooks and notebooks, students are usually in an environment where they cannot use computers. Therefore, we need a tool that is based on mobile devices. Accordingly, we developed a support tool for students' planning for studying and the recording of their study. This tool can be used from the students' mobile phones. In Japan, mobile phone ownership was 86.4% in 2004 (Ministry of Internal Affairs and Communications, 2005). In particular, almost all younger people have a mobile phone. Therefore, we choose cell phones as the mobile device in this study.

FUNCTIONS OF THE NEW TOOL

The new tool has the following three main functions: (1) to display to-do lists and target time planned by the students, (2) to input and save their records of their study, and (3) to display the remaining time for studying according to their inputted records. Schunk & Zimmerman (1998) suggested that the accompanying self-regulatory processes fall into three cyclic phases: forethought, performance or volitional control, and self-reflection. The second phase, that is, performance or volitional control, includes self-observation such as self-recording (Zimmerman, 2004).

The new tool was developed using PHP and MySQL database. Evidently, students can use the tool by personal computers as well as mobile phones. However, since we predicted that many students use mobile phones, we developed a new system that outputs only through simple and light HTML documents to the clients.

PRACTICAL EVALUATION OF THE NEW TOOL

Participants and Settings

To evaluate the developed tool, we had an opportunity to use it in a basic mathematics class at a university in Japan. Twenty-six students participated in the evaluation. All of the students were women, and they included eight first-year students, six second-year students, and twelve third-year students. The students' majors were either human sciences or social sciences. This implied that they had studied mathematics minimally as high school students.

Flow of the New Tool Use

For a lesson at the mathematics class, the students planned their self-study at home for two weeks until the final examination. The students noted the plans on a worksheet (see Figure 1). There were two parts in the worksheets. The first one was the target time that students should devote to study. The other one was a to-do list for the study, for example, to read the textbook or to solve exercise problems. At the end of the lesson, the teacher collected the worksheet. Next, the worksheets were scanned, and the to-do lists were saved in JPEG format. Further, the target study time was inputted by the teacher.

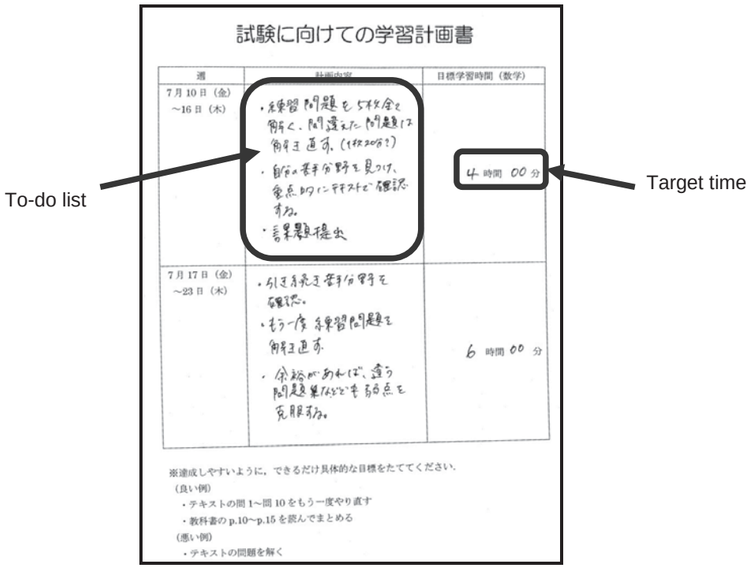

Figure 1. An example of a study planning worksheet

Figure 2 shows a screen of the plan on a student's mobile phone. There are two sections on display. The first one shows the target study time and links for the to-do list. The second one indicates the records of study inputted by the student.

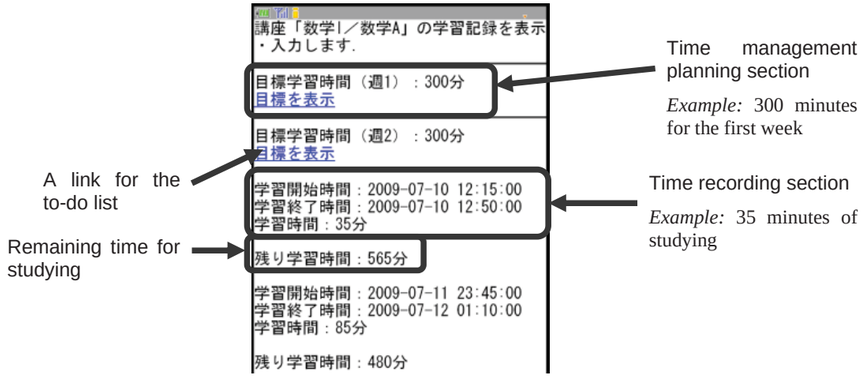

Figure 2. A screenshot example of the links for to-do list and the study records on a mobile phone

Figure 3 shows a sample of the to-do lists made by a student. The image displayed on the mobile phone was exactly the same the student's writing on worksheets (see Figure 1). The translation of the to-do list in Figure 3 is "Review the text in the chapters of set and logic; next, solve and review the questions for which mistakes were made. I will study mainly on Saturdays and Sundays."

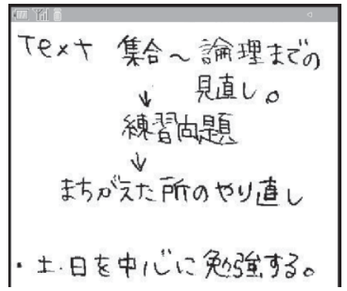

Figure 3. An example of a student's to-do list displayed on the mobile phone

During the final examination of the mathematics class, two weeks after students completed the worksheet, they were asked to answer a post questionnaire. It contained ten items. All items were based on the four-point Likert scale (4: strongly agree, 3: agree, 2: disagree, 1: strongly disagree).

RESULTS

Results from Post Questionnaire

Table 1 shows average and standard deviation of items in the post questionnaire. According to the results, all items are around 2.5; medium of the scale.

No	Items	Average	Standard Deviation
1	I should plan more strictly because my original plan was very vague. (*)	2.92	0.80
2	There are large differences between my target time for studying and the time that I actually spent on it. (*)	2.73	0.78
3	I could easily adhere to the target time planned by me.	2.46	0.76
4	I believe that the target time planned by me was appropriate.	2.31	0.62
5	I should have increased the target time because my target time was too short. (*)	2.65	0.89
6	The tool was useful for my study preparation because I could refer to my planning on my personal computer and mobile phone.	2.81	0.57
7	I was motivated to study further because I could refer to the remaining time for studying on my personal computer or mobile phone.	2.62	0.57
8	I used to refer to my study plans on my personal computer or mobile phone when I was studying.	2.38	0.75
9	I used to refer to my study records on my personal computer or mobile phone when I was studying.	2.27	0.67
10	Since I referred to my study records, I could acquire confidence in my abilities.	2.27	0.53

* shows reversed items

Table 1. Averages and standard deviations of the post questionnaire

However, correlations between the items imply some interesting points. Table 2 shows the result of the correlation analysis. Firstly, a relationship between "referring to my plans (No.8)" and "referring to my plans (No.9)" showed the highest correlation (.66). Therefore, there is a tendency that students who used the tool used both functions for referring to their plans and records. Secondly, there is a high correlation (.63) between the students who believed that the tool was useful for their study (No.6) and those who thought that the tool encouraged them (No.7). Lastly, we found a relationship (correlation: .43~.46) between the students who referred to their plans or records (No.8 or 9) and those who could acquire confidence (No.10).

No	Items	1(*)	2(*)	3	4	5(*)	6	7	8	9
1	Plan was very vague (*)	---								
2	Large differences between the target time and the actual time spent (*)	.35	---							
3	Could easily adhere to my target time	-.47	-.46	---						
4	My target time was appropriate	-.28	-.07	.03	---					
5	My target time was too short (*)	.24	.26	.19	-.38	---				
6	The tool was useful for my study	-.03	-.03	.12	.18	.26	---			
7	The tool motivated me	-.24	-.24	-.04	.12	-.04	.63	---		
8	Referred to my plans	-.22	-.29	.24	.08	-.09	.27	.36	---	
9	Referred to my record	.04	-.16	-.02	.18	-.11	.35	.18	.66	---
10	I could acquire confidence	-.23	-.11	-.02	.22	.04	.31	.35	.43	.46

* shows reversed items

Table 2. Averages and standard deviations of post questionnaire.

DISCUSSION AND CONCLUSIONS

Although the averages of the post questionnaire items were almost neutral, conducting correlation analysis led to some important findings. While the tool was not useful for all students, certain students adopted this new tool for supporting their self-regulation. In fact, there was a correlation between the students who referred to their plans and records and those who could acquire confidence. This fact is important because self-evaluations of learning progress achievement substantiate the students' self-efficacy and motivate them to continue to work diligently (Schunk, 1996).

FUTURE WORK

This research work can be improved by solving some remaining problems. Firstly, after the study planning phase, the teacher prepares the tool by scanning the worksheets and inputting the target times. This task can be very difficult when the number of students increases. Therefore, a study planning function on the tool is required. In addition, if we use digital pens, we can easily acquire the students' handwriting for to-do lists such as that in Figure 3. Secondly, we must identify the students who need the tool because there are some students who can study without using the tool. Finally, since the duration during which the tool was used was only two weeks, we must have long-term experience with regard to the tool. It is possible that students are able to improve their learning style not only for test preparation, but also for daily studying.

ACKNOWLEDGMENTS

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Mobile Phone to Improve English Pronunciation

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ABSTRACT

This paper presents results on a project that used mobile phones to deliver interactive lessons to students so that they can improve their pronunciation of English words to reduce their accents. Mobile phone was used for the delivery to allow students to learn at their own convenience and to make used of the multimedia and interactive capabilities of the mobile phone. Students reported that the pronunciation lessons were useful and that using a mobile phone for improving their English was something they would like to continue. This paper will benefit teachers and trainers of second language learners.

Keywords

Mobile Learning, English as a Second Language, Workplace English, English pronunciation

BACKGROUND

Athabasca University has been involved in projects that investigated the use of mobile technology to improve language skills in the workplace (Ally, 2008; Ally et al., 2008; Yang et al, 2008). Feedback from these mobile learning projects on language skills indicated that students and workers wanted to further improve their spoken English skills. Speaking English with more clarity and having less of an accent was seen as a way to improve workers' performance on the job and their social life in Canada. The students and workers wanted to access lessons and exercises created for mobile phones where they could practice their pronunciation and reduce their accents without needing a teacher. This lead to the development of pronunciation practice lessons using mobile technology to help individuals whose English is a Second Language to improve their pronunciation so that they can reduce their accent when communicating in English. Other studies have looked at use of information and communication technology to improve language skills for English as a Second Language students (Yunus et al., 2009). However, there are no studies that looked at the use of mobile phones in English pronunciation.

METHOD

The project developed animations and short video lessons demonstrating proper pronunciation, as well as additional audio exercises and a comic strip as a visual tool to help in pronunciation. Specifically, the features listed below were added to a website to create the pronunciation practice lessons.

A. Created a mobile friendly **Canadian Phonetic Alphabet** (CPA)

- thirty-eight animations with audio showing tongue, lip, throat and teeth movements and positions during vowel and consonant pronunciation
- two audio and phonetically spelled example words featuring each sound

B. Added **two dialogues** featuring specific sounds to practice from the alphabet followed by interactive exercises focusing on phonetics

C. Created a **comic strip** to accompany a dialogue to help create a visual context for the situation

D. Designed three **minimal pairs** lessons for:

"R" vs. "L", "B" vs. "V" , and "Th" vs. "S"

- Each lesson consists of audio examples of words containing the **target sounds** along with **short videos** showing similar words being pronounced, for example, "right" vs. "light"
- **Tongue Twisters** –one tongue twister for each target sound and one using both sounds
- **Minimal Pairs** –listening exercise for training to differentiate between similar words
- **Listening Pyramids** -listening exercise for training to differentiate between similar words

E. Added a section called **Tips for Accent Reduction**

Subjects for the project came from small English as a Second Language (ESL) communities in Alberta with six subject initially. The subjects were working with volunteer tutors (or waitlisted for one) with the local literacy group, Wordswork. Or, they were working in the community and were invited to join the study by the researcher. The number of subjects that will be involved in the future will be increased as more communities are approached. Fifty percent were employed and working in the community and fifty percent stated that they were neither working nor formally studying. The majority of the subjects were above thirty-one years of age and all were over the age of twenty-six. Most of the subjects use computers on a daily basis, but thirty-three percent had never used a mobile device before. The mobile devices used in this study were first generation iPhones that were lent to the subjects for the duration of the study.

Participants were asked to attend an initial ninety minute training session. During this session the subjects were:

- recorded reading fourteen to eighteen words that contained six target sounds for later evaluation
- given one-on-one instruction on the mobile phone
- shown all sections of the Pronunciation Practice that they would be required to complete on their own in a seven day period

At the follow up session one week later, the subjects were recorded reading the same words as they did at the first session and they also filled out a questionnaire to get their feedback on the use of the mobile technology in improving pronunciation. They were asked to spend a minimum of three hours (including the first session) working with their mobile phones on these materials. All of the subjects completed the minimum requirement and one-third did an extra hour of study. The length of each study session varied with four subjects stating that their sessions lasted from 10-30 minutes; two subjects completed 30-60 minute sessions and one chose to spend more than three hours working on the mobile phone in one session.

RESULTS

The subjects were recorded reading a standard list of fourteen words at the beginning of the training session and once again seven days later. The fourteen words were chosen to illustrate the sounds practiced in the minimal pairs lessons (“s”, “th”, “l”, “r”, “b”, “v”). The subjects were also asked if they had any other words or sounds that they wanted to practice and these words were recorded at both sessions as well. Four of the six students chose extra words to record. The recordings were done in private or semi-private areas with the research assistant encouraging a relaxing and non-threatening atmosphere. The before and after recordings were evaluated on a word by word basis for the target sounds, using a five point scale, by a research assistant not involved in the pilot testing process. The target sounds in the words were given points: 0 = missed, 1 = very unclear, 2 = unclear, 3 = clear, 4 = very clear, 5 = native speaker.

When the six subjects were evaluated for their overall average scores, and the before and after recordings were compared, the results showed that: two subjects improved, two stayed the same, and two worsened. The two subjects who didn’t change their pronunciation scores had the higher scores during the pre-tests and maintained their rankings in the top two to three for the post-tests as well. The subjects who dropped went from scores of 1.7 to 1.2 and from 2.5 to 2.2 staying in the “very unclear/ unclear range.” The subjects who improved went from 1.7 to 2.4 and 2.6 to 2.8. The improved scores moved from “very unclear to unclear” and another improved a few points moving close to a “clear” score.

Individual word evaluations

Each target sound in a particular word was evaluated and rated between zero and five for clarity. The number of words that a subject improved upon, stayed the same, or worsened were also totaled up. For example, Subject F chose one additional word to practice so s/he had fifteen words in total. Of these fifteen words, eleven stayed the same, two improved and two worsened. The subjects whose scores stayed the same had very few of their words either improved or worsen. The individual who showed the greatest improvement had ten of their fourteen words improved. The individual who “dropped” the most showed no improvement in any target sounds, maintained a similar level in six of his/her words and worsened in eight sounds.

Of the additional words chosen to practice by the subjects, fifty percent showed improvement in meeting their target sounds and fifty percent stayed the same. These words were chosen by the subjects as “problem” words that they knew they were having pronunciation problems with.

Questionnaire Results

Subjects were asked to complete a questionnaire to determine whether the lessons and mobile phone helped to improve their pronunciation. When asked if watching and listening to the animations on the Canadian Phonetic Alphabet (CPA chart) helped to learn correct pronunciations, 71 percent strongly agreed while 29 percent were neutral. When asked whether the video and audio pronunciations helped to learn from the lesson, all of the subjects either agreed or strongly agreed that the audio and video pronunciations helped them learn from the lessons. When asked whether they would recommend that other students complete this type of training using mobile technology, 43 percent strongly agreed, 43 percent agreed, and 14 were neutral. Seventy-one percent of subjects reported that their pronunciation improved after completing the activities on the mobile phone. All of the subjects agreed that they would like to see more pronunciation practice lessons and exercises.

Conclusion

The subjects who were involved in the study felt that the pronunciation lessons were useful and that using a mobile phone for studying ESL was something they would like to continue. Subjects reported that they are more aware of sounds to improve their pronunciation and the experience had given them confidence and a new way to look at learning English. Some of the subjects stated that they wanted to work with the mobile phone for longer, but they were not able to access wireless internet in their area. If internet access was more available, it would have been possible that the subjects would have spent more time testing and using the lessons. In the future, unlimited internet access could make for different results in the target sound testing, and pronunciation improvement overall. Further testing with more subjects and with different groups (ESL students in regular programs, technology-based course students, or students in a younger age group) would provide more data with more useful comments and suggestions for the research team. In addition, more research on the multimedia features of the mobile phones should be conducted to determine how mobile phones can be used effectively to improve pronunciation and reduce accent of ESL students and workers.

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English via Mobiles: Potential M-learners Amongst Indian Students and Drivers

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ABSTRACT
Mobile phone penetration in India is currently going through an explosive growth even while growth of internet users is sluggish. Though potential for M-learning is huge, usability research of the technology needs to map the socio-cultural and economic factors for the diverse open user groups. This study uses Depth Interview as a research instrument to study user perceptions about the potential use of mobile phones for learning English. Findings of the study conducted with Students and Drivers indicate the differences that exist between and within occupational groups on areas related to awareness, credibility, choice of delivery methods and flexibility.

Author Keywords
M-learning, India, Students, Drivers, English, Short Messaging Service, Interactive Voice Response

BACKGROUND
According to the Telecom Subscription data of India as on 30th June 2009, the total telephone subscriber base has reached 464.82million out of which wireless subscription is 427.28 million and wire line subscription is 37.54 million (Telecom Regulatory Authority of India[TRAI],2009). While the wireless subscription has seen a remarkable addition of 12.03 million in the single month of June (a growth of rate of 2.63% per month and 48.9% during June 2008- June 2009) wire line subscription during the same period has declined by 0.12 million (TRAI,2009). While mobile telephony has been seeing unprecedented penetration across India, active Internet users in India stands at a figure of 45.3million out of which rural users contribute only 3.3 million(Internet and Mobile Association of India[IAMAI],2009). The annual growth rate of claimed Internet users itself comes to a mere 10 percent (IAMAI, 2009). The relative difference in the growth rates of mobile telephony and internet can be attributed to several reasons. However, the acceptance of mobiles across the length and breadth of India points to the immense opportunity of using this means to make learning possible through mobiles. Though awareness about m-learning and research in the subject is at a very nascent stage, there have been some humble beginnings. IGNOU (Indira Gandhi National Open University) which focuses on Distance Learning has initiated its basic mobile enabled services for all its students spread across the country (Verma, 2008). Nokia has launched a unique initiative called Nokia Life Tools which provides learning opportunities in Agriculture and English. Though such efforts are encouraging, they are still very limited in its spread and working its way towards a viable mobile pedagogy.

PROBLEM STATEMENT
In the Indian scenario where mobile technology is in a rapid growth phase in the semi-urban and rural areas (accounting for the majority of potential English learners), people in general have adopted the wireless technology as a technological tool for their daily need to communicate. However, "widespread acceptance and use of new communication technologies" by Indian populace "does not necessarily point to effectiveness or value in the educational context" (Levy & Kennedy, 2005). The adoption of mobiles as a teaching tool will be a function of "its strengths and limitations both as a technology and as a pedagogical tool, and the social and cultural conditions that surround its use" (Levy & Kennedy, 2005). Dias (as cited in Levy & Kennedy, 2005, p.76) opines that while some users might perceive any use of mobiles for education as unwanted intrusion in their private space, other specific groups of users might welcome it. These indicate the need to conduct research on user perceptions about various aspects of a proposed mobile learning module in India for open user groups.

In this study on user perceptions, 'Usability' has been interpreted as the acceptability of the m-learning tool as a reliable, useful, cost effective, and socially compatible platform for learning (Nielsen,1993). The objective was to elicit data that would help in building the basic grounding blocks for an M-learning ecosystem where 'learning is an engaging experience' with stress on 'effectiveness and efficiency' (Kukluska-Hulme, 2005). It was also to avoid a situation where potential learners reject 'technologies that are unusable', drop out of courses and find 'alternative education and training providers' (Kukluska-Hulme, 2005).

STUDY OBJECTIVE
This survey was designed to obtain data from open user groups of mobile users falling in the category of students and drivers. The survey was aimed at collecting data on the following areas:

a. Need for Learning English and reasons behind the need
b. Awareness about m-learning and prior experience (if any)
c. Awareness and perceived credibility of learning English through mobile phones.
d. Willingness to learn English through Mobiles
e. Choices and opinions about the following different m-learning options for English:
    1. SMS
    2. SMS + IVR (Interactive Voice Response) for listening
    3. SMS + IVR + Live calling for practising speech and testing.
    4. Educational Games
f. Preference about Frequency (Volume and Timing) of SMS, IVR, Live Calling
g. Comparison of traditional classroom teaching vs. Mobile Learning.
h. Price Tolerance for an English training module through mobile phones.

RESEARCH METHODOLOGY
Research Instrument
Depth Interview with a set of pre-designed questions and prod questions was the research instrument and documentation of such interviews was carried out through audio-visual recording without any online editing. The primary pre-survey testing with a sample questionnaire revealed that the subject of M-learning is new for the general population and faulty responses came out of misunderstanding the question. Questionnaire as an instrument was therefore found to be unsuitable for this survey. Depth interviews was chosen for its proven ability of exploring new issues and being a better alternative to focus groups while handling individuals who are uncomfortable to speaking in a group .

Sample Profile and Design
Decisions about sampling design were made on the basis of a primary non-documented interaction with members of diverse groups on topics relevant to English learning and mobile usage.

Sample Profile
Two different occupational groups i.e. Students and Drivers (taxis and auto-rickshaws- three wheeler mopeds) were chosen. The rationale behind choosing these two groups out of all possible 'open user groups' was that these two groups represent the two broad ends of the occupational spectrum ranging from the former having relatively lower degree of mobility to the latter having relatively higher degree of mobility. However, both had the commonality in terms of a generic 'need to learn English'.

Sample Size and Location
The survey was conducted with a total sample size of 45 out of which 30 were undergraduate students and 15 were drivers. Out of 30 students, 15 belonged to general stream (arts, commerce and sciences) and 15 belonged to the engineering stream. The sample for undergraduate students was chosen from 4 different educational institutions located in the rural areas in three different districts (Thane, Satara, and Raigad) in the state of Maharashtra, India. This was because the potential need for learning English is higher amongst undergraduate students in the rural settlements of India. However, the resources for such training are extremely scarce. NRS figures (as cited in IAMAI, 2009) show that out of a total rural literate population of 368 million, only 63 million are English-speaking and out of a total urban literate population of 205 million, 77million are English-speaking.

In the case of drivers, random sample was taken from the city of Mumbai (a metro city with population of 11.9 million) and Pune, a metro city with population of 2.5 million (World Gazetteer, n.d.). The reason for selecting drivers from urban background was that Drivers as an occupational class are found in significant numbers in major urban centers and not in the rural settlements. Also, our preliminary interaction revealed that the need for learning English is more visible in the drivers from the urban background as there was a scope for using it with their clients.

METHOD OF ANALYSIS
The responses for questions that were in strict 'Yes' or 'No' were tabulated as Yes and No. Other questions which drew responses that were related to reasoning and explanations were categorized into dominant themes arising out of such responses. The responses and the hypothesized themes were thereafter validated by a team of 5 independent observers who were competent both in the native language of the respondent and English. Any addition or deletion suggested was verified and agreed to by the majority of the observers. Conclusions about the areas mentioned in the research objectives were then drawn from the numerical tabulation of the responses.

FINDINGS
A summary of the findings in the different areas of survey objective is as given below.

Need for English and Prior Experience

a. Almost all the respondents (93%) across Drivers and Students (only 3 kept silent) were unanimous about the need to learn English. However, there was a clear difference in the reasons for that need. While the dominant reason for learning English amongst students was 'to progress in life' (40%) or 'English is used everywhere' (37%), none of the drivers expressed the reason as 'progress in life'. For the Drivers it was mainly 'good for business' (47%). However, the reason that 'English is used everywhere' was a dominant theme for both the groups (42%) reflects the overwhelming presence of English in an Indian's life.
b. Another piece of useful information is that while 30% of the students had prior experience of trying to learn English through self-help books or other means, only 1 out of the 15 drivers had tried to learn English through an individual effort.
c. The dominant reason for not trying to learn English with a conscious effort was 'No time' for both Students and Drivers.

M-learning: Awareness, Prior Experience and Credibility

57% of the students were confident that mobiles can serve as a teaching device while only 33% of the drivers shared that confidence. This probably came from the fact that 37% of the students had prior experience to some kind of m-learning while none from the drivers had such experience. Amongst the students, the engineering students (73%) were found to be more optimistic about the possibility of M-learning compared to the students from General Stream (40%). This is borne out by the fact that 73% of the engineering students had prior experience of M-learning while none from the general stream of students had any experience. This also probably influenced their relative differences in opting for m-learning if given the choice, as 87% of the Engineering students were very sure about giving it a try while 64% of the general stream students were open about it. However, 100% of the drivers wanted to try it in spite of their lack of prior experience or knowledge about M-learning.

When respondents were asked to suggest ideas on how English can be taught through mobiles (unaided question), 49% suggested SMS and 27% suggested SMS & Live Calls. 22% had no idea to offer. One person suggested only live calls. Within the category of SMS (49%) there were additional ideas of Dictionary, Chatting, Internet Browsers and personal tutors.

Choices about M-learning Options

When respondents were explained the possibility of a English M-Learning module which involved SMS, IVR and Live Calls for Reading, Listening and Speaking respectively, 70% amongst students and 67% amongst Drivers strongly agreed that it would be a better method than just SMS based learning. Though there were no negative responses, the remaining respondents stayed silent which generally bordered to agreement or expressed doubts. The doubts were expressed by 2 respondents through statements like 'It would cost us more to listen and to speak' and 'I think just SMS would be enough and we can do without listening or speaking'. When asked to choose between 'Listening on IVR' and 'Speaking to a Live Caller', 20% opted for Listening and 60% for Speaking. 18% felt that neither of them is necessary and only reading through SMS is enough for their learning.

An interesting aspect about attitude towards educational methodology amongst the general masses in India was revealed when respondents were asked if 'Learning English through educational games in mobiles is possible.' A very strong opposition to the idea was expressed by 47% of the respondents. Only 13% were positively inclined to the idea. Notably, 83% of the positively inclined group was engineering students. 40% of the respondents stayed silent and doubtful. Those who opposed the idea made statements like 'Games are for children...not for adults to learn anything' or 'games are for entertainment and not meant for serious learning'. Those who were optimistic about Educational games expressed ideas like 'learning through games would be interesting and entertaining'.

Preference about Frequency, Volume and Timing of SMS, IVR, Live Calling

SMS

Across both groups (37%), the most preferred volume of SMSs per day is 4-6 SMS. However, the students preferred a higher number of SMSs than the drivers. The most preferred range for the students was 5-6 or above (63% support) and for the drivers was 3-5 (47% support). When asked about the Irritation point for the volume of SMSs, the most common irritation point for 31% of the respondents was for 7-8 SMS.

Preferred time to receive SMSs came in two bands. 43% preferred after 4pm and 26% preferred late evening around 8-9 pm. While the former was mostly the choice for the students the latter was dominated by the choice of the Drivers.

Listening to IVR and Speaking to Live Callers

58% of the respondents who responded to the question on 'how many times in a day they would like to listen to any pre-recorded lessons on IVR' gave a range of 1-3 times. 61% of the respondents who responded to the question on 'how many times they would speak if given the option of speaking to a live caller' indicated a range of 1-3 times.

Taking Tests through mobiles

80% of the respondents said that they would like to take tests over mobile and 9% went against it. 11% stayed silent. 50% preferred to take tests 'once in 7 days', 36% 'once in 15 days' and 14% 'once in 30 days'. There was however a perceptible difference between students and drivers as only 67% of drivers liked the idea of taking tests as against 87% amongst students.

M-learning compared to Classroom learning

20% chose to remain silent on this question. 33% said that Mobile learning would work better for them if they wanted to learn English and they won't miss the classrooms. 47% preferred the classroom training if constraints of time and availability of resources were not there. Responses from individuals who preferred M-learning had 'Anytime anywhere learning' as a recurrent theme along with 'no fear of being ridiculed', 'we are quite responsible' and 'I would concentrate better'. Responses from those who preferred classroom learning made statements like 'Classroom learning is better as the teacher always tells us what to do and will help us if we are stuck somewhere. But in mobile learning the company would send a SMS and if we are unable to understand something then it is up to us to call and find out' or 'reading alone will be boring'. However, only one individual believed that 'm-learning cannot replace classroom learning'.

Price Tolerance

Respondents were asked to indicate the range within which they were willing to spend per month (over and above their current monthly billing) for an English Learning module over mobiles.

27% was ready to spend till Indian Rupees (INR) 100 (approximate US $ 2), 36% within INR 100-300 (US $ 2-6), 17% within INR 400-600 (US $ 8-12) and 11% was ready for spending above INR 600 (US $ 12).

Limitations of the Research

Constraints of funds and resources forced us to choose a small sample size which might prevent us from drawing broad conclusions about user perceptions on M-learning amongst the two chosen categories. Also, the survey being limited to a particular state of India would limit its scope for conclusions to a particular socio-cultural background in India.

CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

The survey indicates that there is a unanimous demand for learning English amongst 'students in the rural towns of India' and 'Drivers in the metro cities'. However, constraints imposed by one's occupation and available resources expose the limitations of traditional learning and opens up a huge opportunity for m-learning. Irrespective of differences, potential learners accepted the credibility of M-learning and displayed willingness to be an active user of an M-learning module .

Issues about learner's 'engagement', 'presence' and 'flexibility' which have been proven as effective criteria for evaluating mobile learning environments (Danaher, Gururajan & Hafeez-Baig, 2009) have been partially addressed. Diversity of responses on potential Frequency of usage for SMSs, preferences regarding listening to IVR, speaking to Live Callers, traditional classroom learning, M-learning and testing options will establish at a primary level that the means of 'engagement', 'presence' and 'flexibility' can be significantly different 'between' and 'within' different occupational categories.

Our ongoing research would strive to validate the above findings with a larger and more representative sample across India. Further research also needs to be done with other occupational categories of open user groups. Responses on attitudes towards educational games create the scope for exploring the prima facie reluctance of Indian adult learners towards accepting educational games as a valid educational tool. The intricacies of designing such games have been earlier displayed by the primary research on designing learning games for Indian children.(Kam et al.,2008).

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Using Mobile Devices to Extend English Language Learning Outside the Classroom

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ABSTRACT
This paper presents Phase 1 of Mobile-Assisted Language Learning (MALL) research exploring students' satisfaction and effectiveness of learning English using iPod Touches. This study results improve the understanding of iTouch affordances and caveats in the specific context: a hybrid English for Special Purposes course for college students. Building on the findings which indicated that iTouches were an effective technology to teach aural skills, Phase 2 of the research will seek to produce effective MALL learning objects and a framework to guide the design of such instructional content. Phase 2 purpose and methodology are introduced in the paper as well.

Keywords
Mobile-Assisted Language Learning (MALL), English for Special Purposes (ESP), iPod Touches, mobile devices, affordances and caveats, satisfaction, effectiveness, mixed-methods, design-based research, aural skills, learning objects

BACKGROUND
In response to an ever-growing need for ESP language courses which prepare our college students for the workplace, we were seeking a solution which would optimize language learning for these very busy adult learners. Occupation-specific language and socio-cultural competencies had to be packaged into a delivery format accommodating specific students' needs and their demanding schedules. The course was to focus on speaking and listening competencies and needed to go beyond the 42 hours of classroom delivery. Additional individualized language practice had to be incorporated and encouraged. At the same time students had to take responsibility for their own learning and flexible access was a sine-qua-non condition.

Mobile-Assisted Language Learning solutions seemed to be the answer. Given that most mobile technologies inherently support oral and aural interaction on the go, we saw them as the vehicle to take language learning outside of the time and place restrictions. Hence a hybrid ESP course (comprising in-class, online, and mobile components) was designed following proven Computer-Assisted Language Learning and MALL theories. The course was piloted and stakeholders' feedback was gathered to shed light on the research questions and promote enhancement of the course instructional design. Our approach was one of iterative refinement of the course design based on student and faculty feedback. The resulting ESP course for entry level accountants was offered as a pilot in January 2009. This paper focuses on the mobile component of the research (Phase 1) and its findings; the resulting Phase 2 of the research is introduced as well.

The mobile content and practice were offered to students through iPod touches which were loaned to them for the length of the pilot. Students used their iTouches to access in-house produced audio-video podcasts and open source content. Accounting terminology and concepts were interwoven with general ESL content and were available to students along with recommended open source podcasts, such as selected ESLpod episodes. Considering the findings of previous MALL research, which identified the difficulties of typing text with small keyboards and the cost of connectivity as barriers to mobile learning, we decided to use the iTouches primarily, but not exclusively, for the provision of listening content. However students were also encouraged to use their iPod Touches to record their written reflections in Wordpress blogs.

The course content was designed following the constructivist philosophy with the emphasis on collaborative discourse. We sought to integrate language learning and technology with student-centred, task-based, and authentic-content approaches (Biesenbach-Lucas, 2004; Hampel & Hauck, 2004; Kern, Ware & Warschauer, 2004). Interactivity was also part of the mix, and it was combined with scaffolding support of a facilitator or peer (Vygotsky, 1978). Mobile learning promised enhanced mobility and flexibility, as well as the ability to be ‘‘spontaneous, personal, informal, contextual, portable, ubiquitous (available everywhere) and pervasive’’ (Kukulska-Hulme, 2005, p. 2).

For the purpose of this research, mobile learning was defined as formal and informal learning mediated via handheld devices, potentially available anytime, anywhere, and offering direct or indirect connection to the Internet. The study focused on mobile devices which offer audio downloading, recording and playback capabilities, as well as connectivity and text-based interactivity.

Questions pertaining to MALL effectiveness and student satisfaction in the specific context were addressed. The findings of this exploratory research resulted in more in-depth inquiry into Mobile-Assisted Language Learning in the college environment. In the next phase of our study, commencing in September 2009, MALL learning objects (LOs) will be designed and developed to be delivered on students mobile devices as part of their hybrid course. The purpose of the next research phase is twofold: (1) to produce effective learning objects that promote the development of ESP listening skills, and (2) to formulate design principles to guide future design and research of such learning objects. This interdisciplinary study hopes to provide a mobile learning instructional design framework which could be easily adapted to other educational contexts. Next section presents a brief description of the methodology used for both phases of the research.

METHODS

This exploratory study (Phase 1) examined the experiences and preferences of internationally trained immigrants vis-à-vis the hybrid design of an ESP course, particularly its mobile component. Questions were asked pertaining to MALL effectiveness and students' satisfaction with it: (Q1) Did students improve their language skills? (Q2) Are iPod Touches an appropriate technology for language learning? (Q3) What affordances and caveats of iPod Touches are pertinent to the learning experience and outcomes? (Q4) What type of language learning activities do students engage in on their iPod Touches most frequently?

To answer these questions, first-hand accounts of student-participants' experiences and perceptions were explored. The purposive sampling method was employed to recruit participants (n=12) for the study. ESL students with particular characteristics were sought to represent the specific population of internationally trained immigrants studying at a community college. They were adult ESL learners representing a diverse cultural and educational background and all 'Confucian-heritage' learners. All students emphasized the multiplicity of school, work and family-related responsibilities which they had to cope with; they also self-reported need for ESP support.

Over the 15 weeks of this non-credit ESP course pilot, students were encouraged to complete all required activities and select from optional content for supplementary individualized practice. Qualitative and quantitative measures were used including semi-structured interviews with students, conducted mid-way through the pilot, and a focus group followed by an online survey (Zoomerang), both administered in the final week of the course. Transcripts of the interviews and focus group were analyzed and coded for emerging themes using NVivo analytic software and subsequently validated by a second independent researcher. Students' language proficiency was measured pre- and post-treatment by the Canadian Language Benchmark Placement Test (CLBPT), widely adopted as a valid and reliable ESL evaluation instrument.

The next phase (Phase 2) of the research will adopt the design-based methodology. The combination of two parallel goals, namely, the design of MALL learning content and the development of a corresponding instructional design framework, makes design-based research a suitable approach for the purpose of this real-world practice study. The methodology of this research adopts the four-stage model proposed by Anderson (2005): (1) informed exploration, (2) enactment (3) evaluation within a local context, and (4) broader impact evaluation. Its activities include:

1. in-depth literature review, closer audience characterization, investigation of comparable design solutions and qualitative data collection via interviews with experts, development of theoretical construct which will guide the design experiment;
2. design and development of prototype listening tasks (LOs) for mobile devices, a preliminary version of LO design principles sketched, feedback from practitioners and experts sought;
3. implementation, formative testing, evaluation, and design framework refinement: listening tasks designed for this particular student population tested with two groups of adult learners (purposive sampling), the tasks and LO design principles modified based on feedback, and subsequently offered to the second group of students;
4. resulting MALL listening LOs studied with another group of students to enable further improvement of the listening content and corresponding design principles; a collection of intermediate ESP listening LOs produced for mobile delivery; the MALL design framework formulated and applied in a broader context.

Qualitative and quantitative measures will be employed to evaluate the impact of the LO design. These will include interviews with students and teachers, paper-based and online surveys, focus groups, correspondence, and the Canadian Language Benchmark Placement Test. Data triangulation will be ensured by the use of multiple data sources.

CONTRIBUTION: RESEARCH FINDINGS

Phase 1 findings contribute to the understanding of mobile learning and, more specifically, Mobile-Assisted Language Learning. This section briefly revisits the research questions.

(Q1) Did students improve their language skills?

Students' progress was measured by comparing the CLBPT pre-test and post-test raw scores and verifying them with the in-class assessments. The four language skills were evaluated separately. All students improved their listening skills: four out of ten improved minimally, one person somewhat, four considerably, and one greatly. Overall, progress in speaking was noticeable yet slightly lower than in listening. Two out of twelve participants did not improve at all, four advanced minimally, three somewhat, two considerably and one student improved greatly.

(Q2) Do ITI learners deem iPod Touches an appropriate technology for language learning?

In general, respondents believed that they learned better using the devices than without the MALL support: three strongly agreed, seven agreed and two had no opinion. At the same time, more students strongly agreed with the appropriateness of the technology for language learning, which was evident through their responses to statements such as "I have improved my language proficiency using the iTouch" (8 strongly agree, 3 agree, one had no opinion) and "The iTouch provided an effective way to learn English" (10 strongly agree, 1 agree, 1 no opinion). Qualitatively, one student explicitly wrote that "Using iPod and learning was a good experience for me" while other students expressed desire for further avenues of iPod use such as "Downloadable lectures on iPods would be good" and appreciation for open source podcasts.

When comparing the above answers we observed some slight discrepancies. Further investigation into the reason for a variance in students' perceived effectiveness of iTouch learning led us to believe that the technical difficulties which learners experienced in the pilot had an impact on the overall experience of mobile learning.

(Q3) What affordances and caveats of iTouches do ITI learners identify as pertinent to the learning experience and outcomes?

Student-participants consistently cited flexibility, portability and convenience as affordances of the novel learning technology. Indeed, students listed learning on the move, opportunity to listen to podcasts as well as an instant access to the Internet and other resources as the key advantages of learning a language with iTouches. They reported accessing free resources such as ESLpod and iTunesU accounting lectures and we observed them exchanging ideas regarding free podcasts. Newly-enhanced technical skills were identified as a bonus benefit and their relevance in the workplace was acknowledged. A "coolness" aspect to using the mobile technology was reported by respondents as a factor which increased their self-esteem. Further advantages cited by the respondents are listed in Table 1.

Advantages	Number of respondents (n=12)
Access to the Internet	8
Learning while on the move	8
Instant access to online data	7
Instant access to audio and video data	6
Learning pronunciation	6
Ability to carry it around	6
Fun	5
Using free time	4
To keep up with email	4
Ability to carry different types of media	3
To be able to read and write blogs while commuting	2
Immediate contact with others	1
Could log thoughts electronically	1

Table 1. What are the advantages of iTouches for learning?

Limitations of the technology were identified as well. The cost of the device and connectivity was rated as the greatest barrier to iPod Touch effectiveness in the learning context. Respondents also named the lack of hot spots, difficulty typing on the small screen and a short battery life as caveats in their ESP learning experience. In addition, they expressed need for more guidance, particularly in finding and selecting open resources.

As already mentioned, technical difficulties were cited as an obstacle despite students' self-reported previous experience with the technology combined with the orientation sessions on iTouch use, as well as other on-going technical supports. Although in the particular question regarding disadvantages of the iTouch, technical problems were not rated as having significant importance (see Table 2), we observed students repeatedly expressing discomfort with the technology and its various functionalities.

Disadvantages	Number of respondents (n=12)
Cost	8
Typing on it not easy	6
Lack of WiFi/hot spots/internet connection in many locations	6
Battery problems	4
Downloading and selecting content, before one can listen is time-consuming	4
Technical problems	1
Lots of functions to learn	1
New technology: I'm not comfortable with it	1
Small screen, taxing on the eyes	1
Lacking interactivity	1

Table 2. What are the disadvantages of iTouches for learning?

Finally, the fact that respondents did not own the devices also acted as a caveat of iPod use for educational purposes. Both qualitatively in the focus group and quantitatively in the survey, students indicated that they would have experimented more with the iPod Touch if they had owned it.

(Q4) What type of language learning activities do students engage in on their iTouches most frequently?

Based on students' surveys and focus group feedback, it is evident that students spent most time listening to and downloading audio podcasts. The answers to "How many hours in total over the 15 weeks did you spend using the following features on your iTouch?" were triangulated with the question: "After the first week, how many hours a week did you spend on average using the following features?" The resulting findings are presented in Table 3. Students indicated that their preference for the listening activities stemmed from the convenience factor and from their lack of familiarity with some of the other features of the device. Students' engagement with aural activities on their iTouches was consistent with their general desire for listening practice.

iTouch activities	Greatest total hours	Least total hours	Number of "0" hours	Average (excludes "0"s)
Listen to audio	**100**	**0**	**1**	**24.15**
Download podcasts	25	0	1	14.25
Browse Internet	40	0	1	14.15
Blog	15	0	6	11.9
Watch video	30	2	0	11.4
Email	30	0	3	10.6
Search podcasts	15	1	0	9.09
Type notes	15	0	4	6

Table 3. How many hours in total over the 15 weeks did you spend using the following features on your iTouch?

EVALUATION AND REFLECTION

Our research was informed by an extensive mobile learning literature review and it verified some of previous findings concerning mobile technology affordances and caveats. MALL proved effective in this small-scale research. The participants of the pilot indeed improved their language proficiency in the areas studied. Nevertheless, the study has to be replicated with a larger sample, with more in-depth focus on specific aspects of MALL, and with various mobile devices. The iPod Touch undeniably enabled an improved access to and interaction with audio and video podcasts, but it did not prove to be equally effective in developing writing competencies. The inherent affordances of the mobile technology, including its audio and video features, were utilized effectively; however, the tool has to be evaluated in the broader context of its use and adoption.

Researchers concluded that learning was impeded by students' reluctance to experiment with the technology at hand and by them choosing solely the more familiar options. Hence more emphasis has to be put on learners' self-efficacy and their familiarity with the technology. To promote additional advancement, more contextualized activities should be designed to utilize the portability of the iTouch as well as a stronger collaborative component should be present.

As noted by the participants, it was the design of the materials and the way they were presented, not the technology used, that impacted the effectiveness of the course the most. The affordances of the iTouch mobile technology were evidently a

vital element of the mix, though. Content and methods have to be carefully designed to take advantage of the unique qualities of any media (Koumi, 1994); thus Phase 2 of our research seeks to develop effective MALL learning objects and a framework for their design.

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A User Created Content Approach to Mobile Knowledge Sharing for Advanced Language learners

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ABSTRACT
Mobile and ubiquitous learning technologies hold out great promise for students of foreign languages who are resident in a target language country, since they can be used in the contexts in which the language learner needs to apply his/her language skills for producing or interpreting language. The CloudBank project aims to integrate a user created content paradigm with mobile learning technologies so that language learners can upload, share and comment on interesting language items they encounter in everyday life in the target language culture. The mobile application is complemented by a Web interface more appropriate for extensive editing and extensive text-based communication, thus combining the affordances of the two platforms.

Author Keywords
Computer Support for Collaborative Learning, User created content, Mobile Learning, Informal Learning, Language Learning

INTRODUCTION
Mobile and ubiquitous learning technologies hold out great promise for students of foreign languages since they can be used on the "front line," i.e. in the very contexts in which the language learner needs to use his/her language skills for generating or interpreting language. Kukulska-Hulme and Shield (2007) report on a variety of initiatives to deliver web materials via mobile devices, podcasting of language learning materials and vocabulary teaching to mobile phone subscribers (Collins, 2005; Levy & Kennedy, 2005; McCarty, 2005; Morita, 2003; Pincas, 2004; Thornton & Houser, 2005; Trifanova et al, 2004). More radical initiatives that have been mooted involve learners not merely downloading information on their mobile devices, but also contributing their own discoveries. Petersen and Divitini (2004) and Kukulska-Hulme et al (2007) point to the potential of such approaches, while Ishikawa et al (2009) have been working for several years on encouraging language students to create their own photographic and video content to illustrate linguistic items.

While each learner's needs and experiences will be different, there will also be many occasions when one learner's experience may be of help or interest to another, especially when learners find themselves in similar contexts, e.g. students at a foreign language University. Learners in situations like these may not be enrolled in formal language classes. International students, for instance, will typically have a high level of competence in the language of the host country and may not feel the need to attend face to face classes. However, they will still be concerned with improving their facility in the language and their understanding of the native culture. In this work in progress paper we sketch the user centred design of a mobile phone application, CloudBank, that combines social networking and user creation features with mobile phone communication and information retrieval functionality to create a collaborative tool to support a community of language learners.

SCENARIO BASED DESIGN
The general impetus for the CloudBank system was to develop a system allowing students to collect, annotate and tag interesting or intriguing language and culture-related content found in everyday life, including text, images and other media. They could upload these content items to a repository for sharing and also for editing and discussion via a Web interface. The overall architecture of the system initially envisaged is shown in Figure 1.

In order to ground the design of the system in the reality of its potential users, a scenario based process was used (Rosson & Carroll, 2002; Pemberton et al, 2005). The first stage in this process was to obtain a solid understanding of our user group, in this case International students at our home institution. We set up two user groups, a larger group (11 participants), who are consulted approximately every six weeks on issues of functionality, terminology and so on, and a core group of a further six users, who are consulted more frequently on issues of detailed interaction design. The participants were recruited by email and via the tutor for a pre-sessional English class. Between them the groups consist of eight postgraduate and nine undergraduate students, with ten different first languages. There are seven female and ten male participants.

From meetings and questionnaire study with the student groups, we developed four personas, to represent the user population throughout the design. As far as possible, characteristics that might influence attitudes to, and take up of, the proposed system were integrated into the persona design, summarised in Table 1.

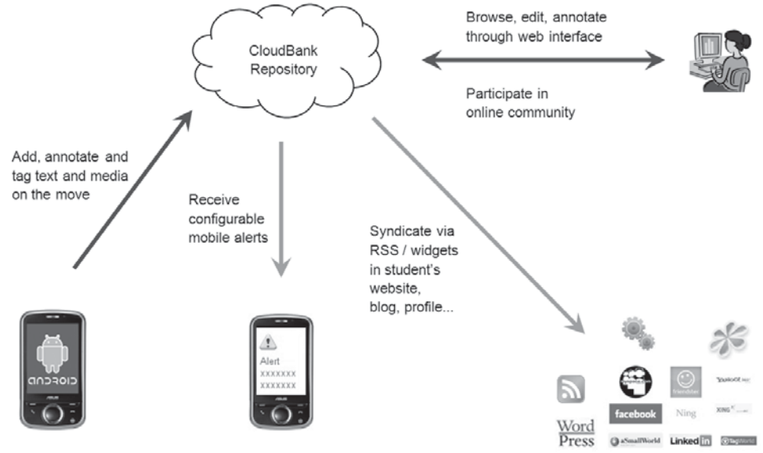

Figure 1. System architecture

Manuela	Brazilian, female, art history, undergraduate student, moderate use of English language social networking sites, moderate phone user
Khalil	Jordanian, male, masters student, engineering student, high use of English language social networking sites, high end phone user
"Maggie"	(anglicised chosen name), Chinese, undergraduate, interior design student, uses Chinese social networking site, basic phone user
Keichi	Japanese, male, Masters student, international marketing studies, does not use social networking sites, high end phone user.

Table 1. Personas with selection of features

On the basis of these personas, user scenarios were constructed to illustrate the possible uses to which the system might be put in different contexts, e.g. social, academic or outdoor. User scenarios have a number of uses in the design process. They can simply be used as a representation of the system for the design and development team, to ensure they share the vision of the system. They are also useful in communicating this vision to potential users, as for instance in our user group sessions, where they can make concrete what might otherwise appear to be a rather nebulous set of concepts. In this way, users can feel confident about commenting on proposed functionality and suggesting refinements and additions.

The use of the scenarios is an evolving process within the project. An initial version was devised simply to ground the design, without direct user consultation.

> Khalil is Jordanian student at the University of Brighton. He is in the Student Union watching a football game with some English friends. A goal is scored and there is much hilarity over the goalkeeper being *nutmegged*. Khalil cannot make sense of this: there's not much connection with the nutmegs of his experience, which are used in cooking. He asks his UK friends what it means to be nutmegged. They explain that it means the striker played the ball through the keeper's legs. Khalil thinks other non-native speakers may be interested in this new nugget of knowledge. He gets out his Android G1 phone, starts the CloudBank app and keys in "to nutmeg: in football, to play through an opponent's legs", tagging the entry with *nutmeg* and *football*. For good measure he also records an English friend pronouncing the word, and adds the recording to the entry, before sending it to the CloudBank cloud.
>
> This same evening, Keichi, a Japanese student, reads the new item about the term *to nutmeg* through the CloudBank RSS feed on his profile page. By chance he's just been watching a video clip of the goal from

tonight's match. He clicks through to the nutmeg entry on the CloudBank community portal and adds a link to the video clip, so that others can get a better understanding of what it means to be *nutmegged*.

This first scenario, once agreed by the design team and funders, was then used to present some of the proposed functionality to the student users, whose comments provided the material for developing first personas and then further scenarios for different personas and contexts. For instance, other users, rather than uploading a known phrase and recording, might type in a phrase they don't understand, photograph an interesting bit of signage, record an unusual local accent or video an interesting interaction. Using multiple scenarios rather than a single one can be effective in widening the appeal of the system to a range of users. For instance, one of our users stated that they could not imagine themselves in a scenario that involved watching football in a pub. However, this did appeal to other participants. Providing a range of scenarios gives a greater chance that each user will find a situation to identify with. An interesting and rather challenging initial finding has been that scenarios illustrating information retrieval aspects of the system, i.e. looking up a word or phrase that someone else has contributed, are much more readily grasped than scenarios in which users contribute to a common knowledge base. This may be because our cohort of international students has a relatively teacher-led notion of education, at odds with the active role we are assuming for the students in CloudBank.

FUTURE WORK

The application is currently approaching its first working prototype stage. The prototype, designed for Google Android phones, will be trialled by members of the core user group, who will be asked to upload and comment on language items over several weeks. Their feedback will be used to design an enhanced version of the software. If the short term project is successful we would expect it to be incorporated into the local learning environment (a Blackboard/Elgg construct) and for it to become part of the learning experience of all ESL students. The application will be trialled in our home institution in the UK, but clearly has the potential to become used on a national basis. Given the connectedness of the modern student, it would be unusual and disappointing if this spread to other campuses were not to happen naturally. Its use could be extended to other languages, to learners "listening in" from their own countries or to other shorter term settings where people need to be able to share knowledge about specialised language. For instance, conferences, University induction weeks and other such occasions might be situations where sharing knowledge in this way via mobile devices would be of use.

ACKNOWLEDGEMENTS

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Smart Use of IBM's Mobile Company Directory

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ABSTRACT
A 2009 IBM/Columbia University research study on mobile use of the company's employee directory uncovers insights into how employees use mobile phones in relation to their work. The paper provides best practice methods for mobile professionals in the private sector on how to improve their job performance.

Author Keywords
IBM, mobile EPSS

BACKGROUND

This paper explores mobile learning from an electronic performance support system (EPSS) perspective for just-in-time access to relevant information. It looks at the effects of employee use of a mobile version of the company directory at IBM, the international technology conglomerate. IBM has more than 400,000 employees worldwide and often looks at ways in which they can better connect their employees with one another. More than 25,000 IBM employees have mobile access to company email, calendar and intranet. IBM partnered with Columbia University to better understand an emerging mobile application for use within the private sector and its greater applicability across different markets.

IBM recently released a mobile application called Mobile BluePages, an internal company directory that is particularly well-suited for sellers, consultants, technologists, managers and executives who comprise the majority of the mobile workforce at IBM. It is designed to enhance the company's ability and efficiency to access the information necessary to serve the needs of each client. This includes such things as client product information, intelligence and solution resources that might be needed to prepare for a client meeting. It can also be used to respond to queries where employees are operating remotely or otherwise might not have access to comprehensive information sources. At times, employees who have face-to-face contact with clients do not have access to internal company networks. This often occurs while they are in transit or visiting a client. Employees at the company had previously indicated that the ability to quickly access information in the field, as well as to locate subject matter experts and receive client intelligence alerts, would improve their ability to respond to client queries and improve their performance. Mobile BluePages provides a subset of the same information as the desktop version of BluePages, used by all IBM employees. Mobile BluePages allows employees who have face-to-face contact with clients to receive critical contact information in a format ideal for their mobile devices. Mobile BluePages allows users to search for employees within the company by name, job responsibility, e-mail address and phone number.

The study of Mobile BluePages is rooted in mobile EPSS, exploring how a high level of job performance can be achieved with minimum human support (Gery, 2003). Given the idea that performance improvement occurs in the same context in which it is applied, this research uses situated learning (Lave & Wenger, 1991) as a primary theory. Situated learning theories emphasize the role of context and social interaction in the process of performance improvement. It looks at providing authentic contexts that can be used in real situations for authentic activities, access to expertise and collaboration with others (Herrington & Oliver, 1995). Additionally, cognitive load, designed to provide guidelines intended to assist in the presentation of information in a manner that encourages individual activities that optimize intellectual performance, is of high importance (Sweller, Van Merriënboer, & Pass, 1998).

METHODS

The research study consisted of surveys and interviews of more than 400 employees about their use of their mobile phone and Mobile BluePages. A pilot study was conducted to compile a list of factors that were then used in part to design the study. Employees were asked a series of questions relating to their job role, frequency of mobile phone use, importance of their mobile phone to performing their job, design and usability considerations and achievement of job goals.

CONTRIBUTION AND EVALUATION

The significant findings from the research study provide implications that can drive the design, development and comprehensive understanding of mobile device applications in the workplace for performance improvement.

High use does not always imply improved performance

Using Mobile BluePages less can possibly be a performance enhancer. This can be true for a variety of mobile EPSS where the idea is that information acquisition leads to less use of it, implying that performance has improved and cognitive load has been reduced. In the case of Mobile BluePages, the availability of a Add to Address Book feature, allowed quicker access to the same information from Mobile BluePages to the user's local address book, reducing the need to revisit Mobile BluePages. One participant summarized it, "The perfect situation is if I never have to use Mobile BluePages." Another echoed similar thoughts, "This is an extremely valuable asset because I don't need to access Mobile BluePages next time to find that person's information."

Holistic point of view

It is important to examine the use of a mobile device from a holistic point of view. This also applies to associated applications in the workplace. A mobile device should be looked at as complementary to a set of technology tools and not necessarily as a replacement. As one participant said, "People should go to a mobile app and recognize it as a subset of what they're used to working." This speaks to knowing one's surrounding environment as well as knowing how the mobile device can be effectively utilized for maximum performance. Here, situated learning approaches help users understand how their surrounding environment can affect the way they use their mobile device.

Performance support

The emphasis of this research study is on performance support systems. It is no surprise that the use of a mobile device for courses, training or education is little to none. This strengthens the argument for the need of EPSS on mobile devices as a primary performance enhancement tool, as opposed to formal courses, training or education on a mobile device. The important aspect to understand is that, in the workplace, users interact with a mobile device in different ways and for different reasons than they do a desktop computer. The nature of using a mobile device is primarily for convenience and thus it is imperative to understand how to leverage a mobile device to support a given task. EPSS is a good fit for this situation and has great potential in the mobile space.

Speed

Speed of accessing a piece of information should weigh heavily on design considerations. Speed of accessing information is a function of good design, efficient programming and connection speed. We live in a fast-paced world when on-demand access to information has become the norm. Waiting just a few more seconds for a piece of information is often unacceptable, especially in the workplace. If good design can save a few seconds without compromising anything else then it should do so. This also relates to the need for reducing cognitive load.

System integration

Mobile EPSS should find easy ways to connect systems and features together. If there are existing systems that all relate to the user's goals, and the application links to them without integrating them in any way, users' expectations will not be met. The lack of availability of an implied task or feature could result in user dissatisfaction.

REFLECTION

This research study is the beginning of an exploration of mobile EPSS in the workplace. Taking the lessons learned from the study, there is an opportunity for future research to help understand this subject more.

Limitations

There were respondents to the questionnaire from various parts of the world. However, due to the nature of accessing Mobile BluePages behind the company firewall, many of the respondents were from major markets such as the United States, Great Britain and Southeast Asia, where there is easier mobile access. Additionally, as a result of a random selection, the follow-up interviews were conducted with only one user outside of the United States. Thus, interview responses could be biased towards major markets such as the United States. Those not responding to the questionnaire may have had too many emails to respond to or were traveling heavily due to their job role. Seventy-five percent of both the 1,000 users contacted and the 412 responses were from the United States.

Networking and collaboration

Mobile BluePages is primarily for one employee to find another at the same company. One feature, however, involved accessing one employee's manager information and reporting structures as a means to connect with someone else. This creates a link between at least three individuals and could open the door up for more social connection applications where one can study the effects of networking and collaboration in the context of mobile EPSS.

Context of use

Mobile BluePages is used in different places and times for a variety of reasons. A new research study can examine in detail the different contexts of using Mobile BluePages and how this affects information access as well as job performance. Additionally, related to situated cognition theories, a technical feature such as GPS can be used to enhance context-awareness and provide a new opportunity for employees to find one another.

Cultural differences

Usage by different cultures and geographical regions could provide insight into cultural factors that affect the adoption and use of mobile EPSS. Conducting a study that not only includes participants from a variety of cultures and geographies but asks about how these factors affect their use can offer insight into designing for cultural differences.

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Mobile Learning of Vocabulary from Reading Novels: A Comparison of Three Modes

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ABSTRACT

A controlled study of vocabulary learning from reading compared three types of mobile technology: paper books, e-books with dictionaries, and e-books with adaptive software for vocabulary learning. The results showed small English vocabulary gains among Japanese students for all three conditions, with no significant difference between the technologies. The students reported that they found the paper book easy to use and annotate, but that the mobile devices enabled them to quickly look up the meanings of words. The additional functions of the adaptive device were only used by a few students. Recommendations are made for further research and design.

Author Keywords

mobile learning, language learning, vocabulary learning, incidental learning, extensive reading, adaptive systems, electronic dictionaries, second language, L2

INTRODUCTION

Mobile technology offers a promising way to support language learning, through easy access to multimedia teaching materials from a portable device that can both provide teaching during the gaps in daily life and tools to support learning on demand outside the classroom (Ogata & Yano, 2003; Ogata, et al., 2006). Several recent studies of second language (L2) vocabulary learning through mobile devices have focused on instructed vocabulary learning, with SMS lessons 'delivering' vocabulary for learners to study at regular frequencies (e.g. Joseph, Binsted & Suthers, 2005; Song & Fox, 2005; Thornton & Houser, 2005; Kennedy & Levy, 2008; Lu, 2008). Studies of incidental mobile vocabulary learning, where the learner acquires vocabulary without consciously focusing on it, have so far been rare (one exception being Song & Fox, 2008). Similarly, although e-book reading on mobile devices is currently gaining popularity, there has been little examination of the potential of these technologies for supporting L2 vocabulary acquisition.

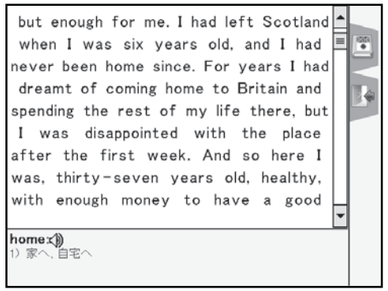
In this paper we report on a study that aimed to investigate incidental learning of L2 vocabulary from reading books. The study involved a carefully controlled comparison of learning from reading in three conditions: paper book, e-book with online dictionary, and e-book with adaptive vocabulary learning support – the English Language Mobile (ELMO) system.

The research was carried out for Sharp Laboratories of Europe. The Sharp team was responsible for the software design and log analysis; the University of Tokushima team was responsible for conducting the study; and the University of Nottingham team for designing and evaluating the study. Although the evaluation was funded by Sharp Laboratories of Europe and the research design was agreed in advance by all three parties, the conduct of the evaluation and reporting of results was not subject to any company influence.

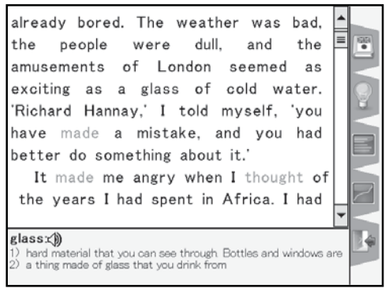
MATERIALS

The paper books were graded readers from the Oxford Bookworms Library, published by Oxford University Press (OUP).[1] The two e-book applications were custom-designed and developed by the company, and ran on Sharp smartphones. As can be seen from the example screens in Figure 1, the applications displayed the text of the OUP books and provided an electronic English dictionary (the *Oxford Essential Dictionary*) for students to look up the meaning of a word by a click (some words had Japanese glosses). All interaction was through touch or stylus. The ELMO system (Figure 1b), also developed by the company, provided additional interactivity, including highlighting words in the text that matched the user's reading level, short vocabulary learning activities accessible by a click (tab 2 in Figure 1b), and learning progress charts (tabs 3-4). The initial level of reading ability was assessed by the user taking a short vocabulary test when first using ELMO. Thereafter, the system employed an algorithm to adapt its response based on the user's progress through the text, the words clicked, and activity success rate.

[1] The Oxford Bookworms Library readers and dictionary were used by kind permission of Oxford University Press.



(a)



(b)

Figure 1. Displays of (a) e-book and (b) ELMO screens.

Two different smartphones were used in the trial, the Sharp WS004SH (3.7 inch colour TFT screen, 480x640 resolution) and the Sharp WS007SH (2.8 inch colour TFT screen, 480x640 resolution). Note that although both types of phone had identical resolution, the WS004SH had a larger-sized display. Although comparison of phones was not part of the original design, the two different phone types provoked some useful comparative responses.

METHODS

The study was conducted at a Japanese high school over a six-week period and involved 39 Year 10 and 11 students, aged 15 to 17. A 'crossover' research design was employed, involving three comparison groups of 13 students each, counterbalanced for order effects of technology. The groups were matched for score on a pre-test of English vocabulary (Paul Nation's Vocabulary Levels Test). After discussion with the research team, the students' form teacher chose three readers from the Oxford Bookworms Library for use in the study: *The Hound of the Baskervilles*, *The Thirty-Nine Steps*, and *Little Women*. All books were Stage 4 Bookworms and had a restricted vocabulary of 1,500 headwords[2] or word families. Each novel was made available in each of the three conditions: paper book, a basic e-book with online dictionary, and the adaptive ELMO system. Each group of students engaged with all three conditions and the order of the technology conditions was rotated, so that each group had a different start condition (see Table 1).

		Cycle A: ***The Hound of the Baskervilles***			**Cycle B:** ***The Thirty-Nine Steps***			**Cycle C:** ***Little Women***			
		Wk1	Wk2		Wk3	Wk4		Wk5	Wk6		
GpA	Baseline test + Pre-test	ELMO		Post-test one	e-book		Post-test two	book		Post-test three	Survey and focus groups
GpB		e-book			book			ELMO			
GpC		book			ELMO			e-book			

Table 1. Summary of the research design.

Initial test

The students underwent an initial test in two parts. The first was a 120-item standardised baseline test of English vocabulary (the Vocabulary Levels Test), testing knowledge at the 2,000, 3,000, 5,000 and 10,000 word frequency levels. Its purpose was to enable allocation of the students to three sub-groups, matched by vocabulary level, and with a similar gender distribution.

The second part was a 90-item pre-test of words selected from the three OUP books (30 words/phrases per book, made up of 20 less common words/phrases from outside the 3,000 frequency range and 10 more common words/phrases from the 2,000 frequency range from each book). None of the words/phrases selected from each book occurred in the other two books. The purpose of the pre-test was to enable comparison with the post-test scores for each book and each condition.

Intervention

In each cycle, the novel was first issued to students in the appropriate format, according to Table 1 above. Students were asked to read the novel over the following two weeks, allocating as much time as they felt appropriate, and using whatever dictionary support they felt appropriate. It was stressed that whilst they were free to discuss the novel, they were not to swap devices or books with one another; and they were given a date two weeks later when they should return their book/device, and when they would sit a vocabulary test on the book they had read.

[2] A headword is the word at the front of a dictionary entry. For example, *go*, *goes*, *going*, *gone* and *went* all belong to the headword 'go'.

The post-test for each book, unbeknown to the students, was composed of the same 30 words which had been used in the 90-word pre-test, enabling a direct comparison to be made between the pre- and post-test scores for each book. The pre- and post- tests were marked by one of the Japanese researchers, each item being scored as either correct or incorrect. Students carried out the reading either at home or on the train journey to and from school.

The third cycle was followed by a two-part questionnaire survey and focus groups. Questionnaires were designed in English and were translated into Japanese by one of the Japanese researchers. Three balanced focus groups of 13 students each were formed, each containing students from each of Groups A, B and C. The focus groups were conducted in Japanese by the Japanese researchers using a schedule of probes and prompts.

RESULTS

The pre- to post-test differences between the mean test scores for novel and for technology are shown in Table 2, along with the mean standard deviations.

		ELMO	**e-book**	**Book**
Novel A (***Hound***)	Mean difference pre-post	1.92	1.39	1.54
	Standard deviation	3.10	2.30	1.94
Novel B (***39 Steps***)	Mean difference pre-post	1.85	1.10	1.10
	Standard deviation	5.27	2.63	4.65
Novel C (***Little Women***)	Mean difference pre-post	0.38	0.50	-1.15
	Standard deviation	2.47	2.30	1.82

Table 2. Pre-post differences between means and standard deviations for the test scores.

A within-subjects ANOVA analysis of the test scores by technology (ELMO, e-book, book) and time (pre, post) showed a main effect of time [$F(1,38)=12.62$, $p<0.001$, $\eta^2 =.25$] but no effect of technology and no interaction between technology and time [$F(1,39)=.72$], as can be seen from the overlapping ranges of the standard error bars in Figure 2.

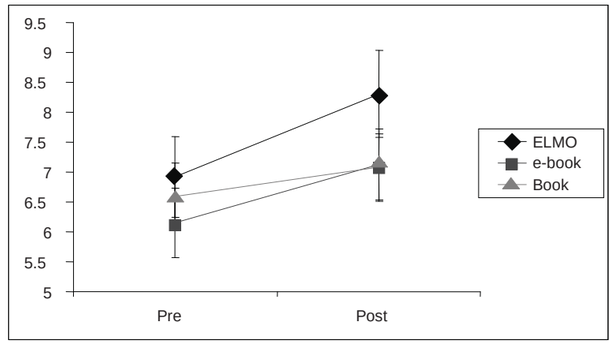


Figure 2. Pre-post mean scores by technology (showing standard error bars).

So students learned from the experience (overall mean pre-test score = 6.55 out of 30, overall mean post-test score = 7.5 out of 30) but the increase in scores was not associated with any particular technology. Moreover, this improvement only has a small effect size, so whilst the result is statistically significant, it may be considered as not particularly 'educationally significant'.

DISCUSSION

The differences in the means shown in Table 2 indicate that students learned, on average, only one new word over each two-week period, regardless of the technology. One explanation for this poor performance is that they did not engage with *any* of the methods of learning. A study of the log files shows that few students read an entire book, with most reading three pages or fewer out of some 100 pages in each book. It would appear that the students found the books difficult and the teacher overestimated their English capability. They were also very busy with official homework and this additional reading was not a priority for them as it did not affect their all-important school reports at the end of the term.

Although differences in preferences for the three modes are also not significant, the quantitative and qualitative data do suggest certain tendencies. For example, the focus group interviews revealed that several students preferred the paper books for their portability, ease of use, lack of strain on the eyes, and the ability to annotate the text. On the other hand,

looking up in a separate dictionary was felt to be “troublesome” (Focus group 3) and the devices were generally seen to be more effective for vocabulary learning:

> “When you want to enjoy reading, ‘paper book’ is better and when you want to learn words, devices are better.” (Focus group 1)

> “I just kept reading without knowing the meanings of some words thus hardly followed the story well [with the paper book]. On the other hand, the devices were more useful because I checked new words, thus I could follow the story more.” (Focus group 1)

Of the three modes, ELMO was rated as both the most helpful and the most enjoyable, according to the questionnaire data: “It was a little fun to do, so it motivated me to learn more” (Questionnaire B, ELMO). Given that several respondents commented that they did not know of the additional activities provided in ELMO, and few found or used the progress chart, it seems probable that reactions to ELMO would have been more positive if the features available in ELMO had been widely known and used.

However, although some students wanted ELMO functionality in their existing phones, they were not willing to purchase an extra device:

> “I do not want to bring another device with me other than my mobile phone to read novels” (Focus group 1)

> “Many say that if it is possible to use ELMO by inserting SD card to their own mobile phones, they would recommend it to their friends.” (Japanese Evaluator, Focus group 1)

CONCLUSIONS

Adaptive software linked to e-books running on mobile devices could offer an engaging means for students to improve their knowledge of a foreign language through incidental learning. But a number of factors need to be considered when designing such systems. Ideally, the software should run on devices that the students already own. It should complement the reading of the book, rather than detract from it, and it should offer facilities for annotating the text. One possibility would be for students to first read for pleasure, marking troublesome words, and then later return to this list for self-study. Another would be to consider game-like opportunities where some demonstration of learning or problem-solving might be required for the user to move onto the next book/level. In terms of research design, care also needs to be taken to ensure that participants can spend sufficient time on task for incidental learning gains to occur. We are conducting further research that takes these factors into account.

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A Student-led Comparison of Techniques for Augmenting the Field Experience

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ABSTRACT

We report a study in which 30 university geography students compared five techniques to enhance the experience of visiting outdoor locations. The techniques were: a pre-prepared acetate overlay of the visual scene; a custom-designed visitor guide running on a PDA; the mScape location-based software running on a GPS-enabled mobile phone; Google Earth on a tablet PC; and a head-mounted virtual reality display. The students were given the assignment as part of their assessed coursework for a field trip to the UK Lake District, where they had to evaluate the techniques and propose improvements or future designs to enable tourists or students on field trips to gain an enhanced understanding of their surroundings. The paper describes these techniques, reports the process and results of the student assignment, and concludes with a discussion of some broader issues emerging from the project.

Author Keywords

Mobile technologies; visitor experience; field trip; geography; student comparison; evaluation

INTRODUCTION

Previous projects have demonstrated the educational potential of using digital technologies to augment real-world environments (e.g. Ambient Wood (Rogers et al., 2004)) and the value of incorporating geospatial awareness into mobile learning systems (e.g. the Savannah project, (Facer et al., 2004)). There are many different techniques for augmenting the learning experience in outdoor settings, with their own characteristics, capabilities and restrictions. The learning objectives may be subject specific, e.g. to help geography students to develop an understanding of geology and surface landscape characteristics, or they may be more general, e.g. to enable a tourist to gain an appreciation of the landscape and its heritage. Specific mobile technology platforms may be used as a means to address these learning objectives.

We present a student assignment in which the students reflected on the effectiveness of the techniques themselves, compared a range of technologies side-by-side in the field, assessed their value for augmenting the visitor experience and suggested potential improvements. The exercise formed part of a Geographical Information Science (GIS) module available to undergraduates and taught postgraduates at the University of Nottingham. The learning objectives related to the design of robust, useful and usable technology and to the effectiveness of various forms of data representation in engaging the user with the real world landscape. The exercise was framed around the requirements of tourists to the area and students on field trips wishing to know more about the landscape.

BACKGROUND TO THE WORK

The field trip is a very effective mode of teaching and for generations of students these field trips provided popular and memorable experiences, often crucial in understanding aspects of biology or the natural sciences (Rieger and Gay, 1997). However, field trips have gradually fallen out of vogue because they do not easily scale to large numbers. An important element of a field trip is to identify features in a landscape, e.g. evidence for glaciations or mine workings. Often the educator or a knowledgeable guide would lead groups of students around in the field and point out features of interest to the group. With large group sizes, this one-to-many model becomes less effective and difficult for students to engage with appropriate features in the landscape. Many of these functions would be best served on a one-to-one basis between the field guide and the student, given the often inclement environmental conditions and the need to hear clearly what the field guide is saying and see exactly where they are pointing. Inevitably these functions are provided in a one-to-many fashion, with many students failing to gain any benefit when on the periphery of a large group.

In a similar manner to students on a field trip, tourists who visit a location often wish to know more about the surrounding landscape. There is a long tradition of publishing guidebooks that offer “descriptions of scenery...written with good literary taste” (quotation from *The Daily Telegraph* July, 1901, in frontmatter to Baddeley, 1906). More recently, mobile technology has been designed to enhance the tourist experience by providing location-specific information in the form of text, images, sounds and video (e.g. Pocket London, www.pocketlondonguide.co.uk). Handheld devices combined with GPS (Global

Positioning System) sensing capabilities, have enabled a user's current position to be used to query any spatially referenced data held on the device or accessible over a network.

Early examples of computer-supported field work include "Wireless Coyote", where children used modified tablet PCs to record and share information relating to the environment (Grant, 1993) and "Cornucopia", where undergraduates used mobile devices to record data for different varieties of corn (Rieger and Gay, 1997). The "Plantations Pathfinder" application provided electronic information for visitors to a garden attraction, meaning it could be updated more quickly than printed matter and could record a visitor's interests as they toured the garden with the device. It also enabled interaction between visitors (past and present) via online discussion forum (Rieger and Gay, 1997).

These projects were indeed location-based, but were not yet "location-aware", in that the mobile devices under consideration did not yet possess any location-sensing technology such as a GPS receiver. This has changed over the last decade, due to improvements in computing and wireless networking, in particular the growing availability of GPS sensors in consumer devices and also the incorporation of GIS technology and data into mapping applications (Stenton et al., 2007).

An example of location-aware field work has been published by Pascoe et al., where a PalmPilot running the "stick-e note" system was used by ecologists in Africa to record contextual data relating to the behaviour of giraffes (Pascoe et al., 1998). "GUIDE" is an example of a location-aware electronic tourist guide for use by visitors to Lancaster, providing personalisation based upon a visitor's own interests and also various environmental parameters (Cheverst et al., 2000). Finally, a well-known location-aware application is the "mscape" platform, developed by HP Labs as part of its Mediascape project (Stenton et al., 2007). These "mediascapes" provide multimedia-rich, context-sensitive location-based experiences, where logic and pre-defined rules related to a user's location determine the behaviour of the triggered media.

Current technologies have evolved the potential for location-aware mobile devices to become powerful aids for fieldwork, where we can measure, record and share a rich variety of information and experiences with other users, both in real time and asynchronously (Tinker et al., 2002). There is clearly much research interest in developing tourist guides based on mobile technologies, but from a teaching and learning point of view there is a great opportunity to develop methodologies that allow students to evaluate the effectiveness of various techniques. Where we have access to geospatial data and technology, the usability of the device and the effectiveness of data representation can become foci for the learning objectives, rather than using the mobile device as a means to an end in addressing subject specific learning objectives.

This paper reports on one such methodology designed to allow students to compare a range of mobile technologies in terms of their ability to complement, or augment, a person's experience in the field. The exercise developed, entitled 'Augmenting the Visitor Experience' formed one day out of a four-day residential fieldtrip in the English Lake District. The development of techniques used in this day project was partly funded through the SPLINT (SPatial Literacy IN Teaching) project, a collaboration between the University of Nottingham, University College London and Leicester University (lead partner). It is a Centre for Excellence in Teaching and Learning (CETL) and funded by the Higher Education Funding Council for England (HEFCE). At Nottingham, the primary concern has been the development of tools, techniques and strategies for enhancing the use of spatial data in geography curricula, and beyond, using GPS-enabled mobile devices and semi-immersive virtual reality displays.

METHODOLOGY

The study site for the development of the 'Augmenting the Visitor Experience' project was the area around Keswick in the English Lake District, Cumbria, UK, an attractive upland environment popular with tourists and walkers. The project occupied part of a residential fieldtrip involving around 30 students working in small groups (most of whom had taken pre-requisite modules concerning basic GIS) and had a good understanding of digital geospatial data to support in-field tourist guides. The learning objectives of the project focused on developing a critical awareness of the issues that arise when designing and implementing robust and effective mobile tourist guides. A number of different techniques and technologies were made available to the students, who were asked to design a programme of testing in the field to expose those capabilities of the various systems that showed most promise. It was also important for each group to gather evidence of the system features that proved problematic (e.g. usability issues; difficulties associating various media with the landscape features), using photographs and video recordings.

Five techniques were made available, and no prior knowledge in their use was required. The techniques are described below, and pictured in figure 1:

- **Computer-generated acetate.** A 3D landscape model of the area was available on a desktop package (Bryce 5) which contained a terrain model draped with aerial photography, as well as alternative geology drapes and a scenario for a retreating valley glacier. The students could generate 3D views from any known location in the model, print the views onto acetates, and then visit the real locations in the field. Holding the acetate up in front of them allowed features on the acetate to augment the real scene, for example the size and extent of the retreating glacier could be seen in the context of the present day valley.
- **Bespoke PDA application**. A PDA application was developed to utilise the images created for the acetates, but to upload them onto a GPS-enabled PDA. They then formed waypoints and were automatically displayed as the used reached the appropriate location in the field. The user could switch between the alternate views, sketch over the display, or listen to audio recordings describing certain landscape features visible from that point.

- **Mediascape on a mobile phone**. A range of media elements, (images, videos and audio recordings), were made available to the students who could then create their own mediascape and test it on a GPS-enabled mobile phone. The students defined the size, shape and position of trigger regions on a map, and assigned media elements of their choice to those regions. Once their mediascape was uploaded to the phone, they could test the effectiveness of various media as they were automatically displayed or played, as the user reached the pre-determined locations.
- **Google Earth on a tablet PC**. The virtual globe Google Earth was made available on GPS-enabled tablet PCs, with data for the area cached on the device. An external GPS connected to the tablet PC enabled the user's current location to be shown on Google Earth and they could then adjust the 3D view to match the view in the field. Image drapes representing topographic information and geology could be switched on and off.
- **Head-Mounted Display.** An experimental system (described in more detail in Jarvis et al., 2008) comprising a Head-Mounted Display (HMD) linked to GPS and an inertial device, allowed a 3D virtual model of the retreating glacier to be rendered to the user in real-time, synchronised to their position and to the orientation of their head. The user is aware of the real scene via their peripheral vision, and can flip the visor up at any time.

Figure 1. Techniques for augmenting the visitor experience (left to right): pre-generated acetate; bespoke PDA application, mediascape on a mobile phone; Google Earth on a tablet PC; and Head-Mounted VR Display.

The information offered by each technique was not exactly the same in each instance, and the choice of information content was not intended to form a complete tourist guide experience. Instead, it represented a sample of the sort of information that can be used to augment the user's experience of the landscape scene. However there was great diversity in terms of the technological sophistication, the size and nature of display device, the mode of interaction, the use of audio, and the way in which information was represented. After the exercise was complete, the students presented their findings in a 20-minute talk, which included evidence in the form of video footage they collected during the day.

CONTRIBUTION

The value of this approach is seen in offering students a wide range of techniques, with different modes of interaction and varying capabilities, in the context of the development of mobile 'augmented' tourist guides. Rather than use a single technique as a means to an end, the project focused the learning objectives on the design of robust and effective technologies, using in-field video to gather evidence of usability issues. Initial findings have confirmed the project as a useful platform for students, and indeed the authors, to engage with issues relating to the challenges of making expert knowledge about various landscape themes work effectively through different mobile platforms.

EVALUATION

The students found the exercise interesting, and even fun. They identified many issues relating to both the usability of the technology and the design of the media and information used with such technologies. Over ten issues were mentioned, the most important being: the simplicity of design and ease of user interaction; how rugged and weatherproof the technique was; the size and visibility of the screen; and the ease of associating information with the landscape such that it became relevant. Almost without exception the student groups developed clear schema by which they chose to evaluate the techniques and also clear recommendations for the design of a system for the future. Whilst differing terms were used to describe their schema, the three broad areas for evaluation related to the device itself, the nature of interaction, and the usefulness of information provided. Interestingly there was great variety within each of these broad categories in terms of the performance of the various techniques. The format and simplicity of the acetates proved surprisingly popular, leading two groups to offer 'electronic acetates' as their visions for the future. The PDA device proved popular in function and screen size but performed badly in terms of stability, including issues with GPS connectivity. Mediascape proved very popular in terms of the ability to control media placement and ultimately affects the usefulness of the system, however the small screen size and modes of interaction let it down. The tablet PC suffered from similar stability issues as the PDA although the combination of large screen and an extensible data exploration environment in Google Earth were attractions. Finally the Head-Mounted Display showed merit, and was fun and engaging, but it was thought that the technical complexity and lack of robustness would prohibit any use in a public context in the near future.

In terms of evaluating the success of the exercise from the viewpoint of the authors, it succeeded in engaging students in a group-based evaluation exercise and led to a critical awareness of the capabilities and limitations of certain mobile technologies. Evidence from the 'Student Evaluation of Module' forms suggests that students appreciated the use of a hands-on field exercise to engage them with what they considered relevant both academically but also in a commercial sense. The student video diaries themselves form an interesting resource which will help the authors explore certain usability issues that the students themselves did not pick up on. For example, several videos revealed that students were looking at

one landscape feature whilst listening to an audio commentary which related to another feature. This relates to a broader issue of how people connect media with landscape when accessed through a mobile device in the field, but also how we can evaluate technologies for facilitating such a process. A significant finding of this work may be that the student-led video diary may indeed form a rich source of material for further exploration of how situated media works in mobile learning.

REFLECTION

In addition to the successful technical comparison and the clear ability of students to develop schema for describing the attributes of various systems and techniques, some broader issues of interest to the mobile learning community are emerging. Evidence, in part from student video diaries, suggests that significant challenges exist in the development of robust and effective techniques for allowing users to relate a piece of information on the device with the real world feature or area to which it relates. Of particular interest is ability to automate the function of the human field guide in pointing out landscape features whilst being able to affirm user engagement first. For example a guide could say "You see that forest over there?" and only on seeing that the other person had identified that feature would continue with "OK, well that was the first purchase made by the National Trust". So not only do we have issues relating to the relevance of a piece of information to a particular user's context, but the ability to directly associate that information with a feature in the landscape is of interest, in terms of both the system design and the techniques used to observe and evaluate this process in the field.

One feature of the exercise which could be developed further is to more explicitly evaluate the effect of various techniques for augmentation on the process of knowledge construction. An example could focus on the understanding of the landscape history of the study area, and to develop a post-exercise task which involved the users describing, even mapping out, the important influences on the landscape they had experienced that day. In a field work context, this relates to attempts to replace the one-to-many model often used to disseminate information to groups of students in the field by some kind of mobile field guide. The broader context of this work also relates to how heritage information and other material relating to landscape themes (from glaciation to mining) can engage and enlighten visitors.

Experiences from the first run of this exercise have suggested further developments for the next field season. The authors have begun working with specialists in the development of handheld applications which make use of the internal compasses on devices such as the Google phone and the iPhone, offering handheld augmented reality through the phone's camera and screen (as with applications such as Wikitude). The emphasis on visual augmentation will be supplemented by a more detailed study of the effectiveness of situated audio, focussed initially on one particular expert domain, for example the history of mining in the area. The user requirements for such a system should be relatively easy to define, and organised field tours by an expert already occur within the study area, on which to base the mobile guide.

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AnswerTree – a Hyperplace-based Game for Collaborative Mobile Learning

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ABSTRACT

In this paper we present *AnswerTree*, a collaborative mobile location-based educational game designed to teach 8-12 year olds about trees and wildlife within the University of Nottingham campus. The activity is designed around collecting virtual cards (similar in nature to the popular Top Trumps™ games) containing graphics and information about notable trees. Each player begins by collecting one card from a game location, but then he or she can only collect further cards by answering questions – whose solutions are obtainable through sharing knowledge with other cardholders. This ostensibly allows each player to become a subject expert at the start of the game, encouraging collaborative interaction for the game to be successfully completed. In this initial paper we will outline the structure and background of this location based game. AnswerTree has been authored within the Hyperplace framework, and is a first implementation of a wider process to develop a flexible, multi-purpose platform for both individual and group location-based mobile learning.

Author Keywords

Collaborative learning, mobile learning, jigsaw learning, trees, location-based services

INTRODUCTION

Mobile technologies that are aware of their location have become increasingly ubiquitous over the last few years (Milanesi et al., 2009). It has therefore now become both feasible and logistically straightforward to implement learning approaches that harness both an individual's location and other contextual cues, with content being delivered directly to mainstream mobile devices without the need for any specialist hardware. In this paper we present *AnswerTree*, a location-based educational game authored within the recently developed *Hyperplace* platform (Goulding and Swan, in preparation) that investigates the effectiveness of collaborative learning within a context-aware mobile system.

The AnswerTree case study explores how we can use contextual (in this case, location-based) data to support collaborative mobile learning, with an additional focus on whether this can be successfully supported within the Hyperplace framework. Whilst learning is often viewed as an individual pursuit, with a student's head stereotypically buried in a book (or possibly next to a screen), learning is frequently – and perhaps predominantly – a social activity. However, models of learning in a social context vary enormously. One model that has served as particular motivation for the development of AnswerTree is that of Aronson's *jigsaw learning* (Aronson & Patnoe, 1996; Aronson et al., 1975).

In jigsaw learning a class is divided into groups, with each group being divided into "subject experts". Individual experts from each group then join together to collaboratively research the topic they have been designated, before reconvening with their initial groups. Each expert then educates the rest of the group on their particular subject. It has been shown that collaborative learning of this manner can be mediated through online experiences (Clear & Kassabova, 2005) – and increasingly so with the adoption of Web 2.0 practices (O'Reilly, 2005). However, with AnswerTree we extend this investigation into mobile, location-based settings, building upon previous projects that have explored user interactions with mobile devices in outdoor environments (McCarthy & Meidel, 1999; Pascoe et al., 1998; Rieger & Gay, 1997).

As the devices available to potential learners have grown in sophistication, both in terms of their computational/presentational abilities (e.g. CPU, screen size, colour depth and resolution) and their awareness of their surrounding contexts (e.g. GPS, inertial sensors and compasses), the flexibility and sophistication of the learning experience that can be delivered has also increased. Learners can now carry around the computational equivalent of a desktop machine of 5-10 years ago but, of even greater note, are the advancements in *connectivity* – 3G services have facilitated communication of mobile devices to a central server, allowing real-time coordination and interaction between participants. This, combined with the fact that the technology to accurately determine a device's position (especially in an outdoor environment) has become cheaper and therefore increasingly ubiquitous, has created empowered mobile learning platforms that can use a wider awareness of their context as part of the learning experience (Cheverst et al., 2000; Davies, et al., 2001; Ghiani et al., 2009; Rieger & Gay, 1997; Rogers et al., 2004). These efforts have predominantly produced bespoke applications focussed on individual areas (with notable such as *Mscape* (Hull et al.) for the Windows Mobile operating system). In contrast, the Hyperplace system on which AnswerTree is based is intended as a ubiquitous platform

for authoring a range of location-based experiences. This platform is first discussed before AnswerTree is examined in further detail.

HYPERPLACE

Hyperplace is a new client-server based platform for location-based games and services, running as a threaded Java-based server combined with a geospatial database backend in order to store game state and locational information. The server itself stores all of a game's content, presentation logic and rules. This information is transmitted to mobile devices as required through GPRS or (ideally) 3G communications, meaning that clients can be particularly lightweight with the server doing all the heavy lifting and processing (although caching is available on the mobile device when necessary).

This system has been designed to result in a very simple "browser-style" client for the mobile device itself, allowing the front-end to be quickly ported to new mobile platforms[1]. This is aimed specifically at increasing ubiquity and to offer a similar experience to each participant, whichever mobile device that they are using. Once the Hyperplace browser client is installed, any Hyperplace game or service may be used within it without any further installations being required.

Every Hyperplace game consists of three things: a set of game *actions*, a set of game *rules* and a set of *events* that these can generate, with instructions on who needs to know about them. With these three authoring components in place all Hyperplace games then work in a similar fashion – the server sends game updates to player devices, which render these updates (or *statelets*) on the appropriate section of user interface. Players then generate game actions in two ways – either directly via the user interface (such as answering a question or by clicking the map), or indirectly through their behaviour in the physical world (such as moving into a new area). These actions are sent to the server, and administered by the game's particular ruleset. This results in new events being generated that change the state of the game, and when this occurs updates can broadcast to any devices that are impacted by the new state. This circular process is illustrated in detail in Figure 1 below.

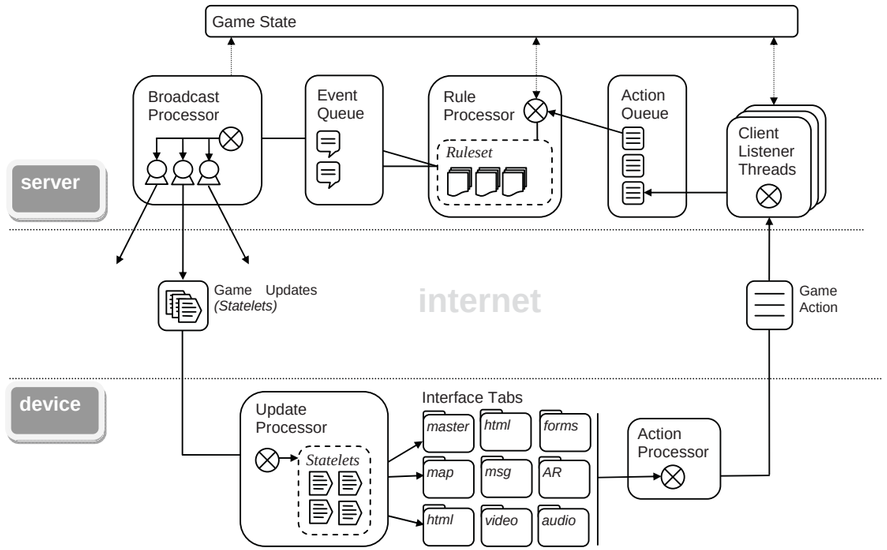

Figure 1. The Hyperplace framework – the interface on the mobile device is composed of a range of tabs. AnswerTree uses 3: Map – a map tab (detailing important locations), Your Info – an html tab for displaying game info (such as the information about the player's current location and their progress in the game), Actions – a game forms tab (with buttons to generate actions such as answering questions, or reading collected cards). A video stub is also currently present in the client but not active. When the player produces an action it is sent to the server, which passes it through the game logic and generates an appropriate response, including any updates to the client interface of affected players.

[1] Currently clients exist for Google Android and Apple OS. AnswerTree has been played on HTC Magic and G1 phones.

ANSWERTREE

AnswerTree is a specific implementation of the Hyperplace platform. It is based loosely on the idea of a group *Top Trumps*™ game. The aim of the game is to collect all the cards in a set about a particular type of object, in this case the trees around University Park at the University of Nottingham. University Park has a rich heritage of arboreal collections, with over 7000 individual specimens and around 200 species present, including some found nowhere else in the UK.

Each learner starts off at the location of one of 5 trees and gains an information card about that tree. They then have to collect the information cards about each of the other trees. Subsequent cards are collected by going to the location of the other trees to collect a question about that tree and then answering that question correctly. The questions are all based on information contained within the card for that tree, so the player must seek out another player that has the card for that tree. The question presented is randomly chosen from a pool that exists for each tree (examples are *"How many different species of wildlife does an oak tree support?"* and *"For about how many weeks per year, does the Cherry Tree flower?"*). Each player's initial tree therefore implicitly becomes the area that they are designated an *expert* on at the start of the game. As the game progresses and more questions are answered and cards collected the number of experts rises until one player has collected all the cards – they are announced as the winner and the game ends. Screenshots from the game are shown in Figure 2.

Figure 2. Screenshots of the AnswerTree application running on a Google Android-based mobile phone platform – the *map tab* (the white person icon represents the player) and the *info tab*.

EVALUATION

Since AnswerTree is still in its infancy, a full evaluation has yet to take place. However, initial evaluations carried out by observations and semi-structured interviews with 15 beta testers have provided the following information:

Usability of interface: The tabbed nature of the interface worked well to provide a lot of information in a manageable, usable interface that was well focussed to an individual task. The size of screen was reported as good, with instructions and the map clearly legible and easy to read/follow. Some further development of the on-screen messages was required to enhance clarity. The on-screen keyboard and phone keypad were easy to use and accurate when pressing keys, giving low errors on data entry.

Importance of audio feedback: Testers experienced the game both with and without the integration of audio notifications. Initial observations indicate that audio triggers (such as the when a new tree location is entered, or when an action is successfully completed) are particularly effective in improving orientation within the game. This seems due to the fact that game areas are necessarily fuzzy due to the constraints of GPS accuracy, and because players are often not able to view their display when moving.

Robustness of technical infrastructure: The spatial database communicates seamlessly with the Hyperplace server, which in turn responds almost instantly to client software, allowing location-based data and updates to be synchronised in real time. The average delay between action and response was less than 2 seconds. Maximum delays were noted within the range of 4-5 seconds, occurring when 3G connectivity was momentarily lost. While this is of little concern in environments with a high level of connectivity, it could represent a significant issue in areas of weaker infrastructure. Extension of the system's caching capabilities to handle dropouts or increases in data communication latency must be explored further.

Multi-modal communication: Players were also able interact via phone calls or text messages rather than just through face-to-face means. Although seemingly obvious, the use of mobile phones to allow this facility, when utilised as a gaming platform, is often overlooked. This has proved very successful in allowing the capture and analysis of complex social interactions in another Hyperplace-based game and further work is planned to investigate this within AnswerTree.

Battery life of devices: Hyperplace creates intense computational and sensor loads upon a device, meaning that play time for the games is constrained, usually to under an hour and a half. Larger battery packs can be used to somewhat mitigate this limitation but game design and usability issues need to also be considered.

Limitations of positioning: GPS requires a clear view of the sky on order to provide accurate positions. Tree canopies can obscure this view and so interfere with the game as the players are supposed to be close to the trees in order to interact and claim either the tree itself or a question about the tree. Initially this has been overcome by careful selection of the game space and zoning of the interaction areas. In the future additional technologies, such as near-field tagging, may be used to identify action points for the system.

Further evaluations are planned for early 2010 that will consider educational outcomes from this game, particularly in relation to learning science at Key Stages 2 and 3. We also plan to investigate how AnswerTree could be used to support group learning, in addition to individual learning.

CONCLUSIONS

In this paper we have described AnswerTree, a collaborative location-based educational game designed to promote social interaction and inform KS2/3 students about trees in a fun, game-based manner. The game was run on the Google Android mobile phones, allowing a rich set of complex interactions to be presented and investigated. Initial evaluations surrounding technical and usability issues have indicated the potential for this game to be used with school children to provide environmental education. Further, more extensive trials are planned in the next 6 months, with several groups of target users. The results from these trials will be published in due course.

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Supporting English Course with Customized Mobile E-mails

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ABSTRACT

We conducted the survey on 296 Japanese university students about the use of mobile phones and found out that they preferred mobile e-mails to mobile web-browsing in English class. Based on this result, we propose adaptive mobile-based English learning support system (AMELSS) using mobile e-mails in order to solve the problem of lack of learning time in Japanese EFL education. Two experiments using AMELSS are under preparation to find out some answers to the following questions: (1) Does the use of mobile e-mails support learning English? If so, how often a day should learners of English receive e-mails for the most effective learning? (2) Does our extended adaptive learning system to deliver customized contents help learn English? Some possible advantages of this system are easiness of its implementation, close link between in-class learning and outside-class learning, cover the lack of learning time, able to learn anytime, anywhere, while its possible disadvantage might be unfairness for the students who do not have mobile phones.

Author Keywords

Mobile Language Learning, EFL, Mobile Phones, E-mails

INTRODUCTION

Learning time of English at school is not sufficient in Japan: 630 – 650 hrs during 6 years of junior and senior high school education (Takeuchi 2007), plus 112.5 hrs, for an instance, during college years at our university (based on the University of Tokushima enrollment guideline 2009). Shortage is apparent when we consider the fact that 1200 hrs is necessary to achieve basic level of French language in Canada (Ito 1997). As Lan et al. (2007) have pointed out, “due to globalization and internationalization in recent decades, English has become the lingua franca of the world.” Thus there is an increased need of EFL (English as a Foreign Language) education. Japan is not an exception. In fact, Ministry of Education, Culture, Sports, Science and Technology have decided to introduce EFL education at the elementary school level from 2011. But it doe not mean it will solve the lack of learning time. Then how should we cope with this shortage problem? If time to study in class is limited, there is no other way but to learn outside class. Then it is important to establish the effective method to carry out outside-class learning. One solution is mobile learning, which has been gaining global attention in recent years. Since mobile phones are most popularly used in Japan, we conducted a preliminary survey over 296 Japanese university students, freshmen and sophomores mostly, about how they liked to use mobile phones in class.

SURVEY RESULTS

According to the survey we conducted over 296 university students, 293 reported owning a mobile phone and 100 % of owners were mobile e-mail users. So it endorses the popularity of mobile phones among college students in Japan. We also conducted a preliminary survey on pros and cons of the use of mobile phones in class activities. Unlike the left circle graph in Figure 1, which shows more than half of the students are for mobile e-mail use in class, the right circle graph shows that the students seem to have negative attitude toward the use of mobile web browsing mainly because web-browsing by mobile phones are costly. Thus we suggest the use of mobile-based e-mails to support learning at home in order to compensate learning time at school. In fact, researches on mobile language learning have been very active in recent years (Thornton & Houser 2005; Levy & Kennedy 2008; Nadire & Dugan 2008). However researchers’ attentions have mostly been paid on informal learning, or self-learning and little attention has been paid on mobile learning closely associated with the materials taught in class at school. So the main emphasis in our system to be proposed below is put on the close links between learning in-class and outside-class.

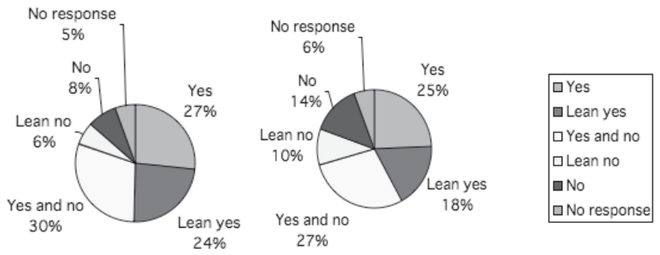

Figure 1. Survey on pros and cons of mobile e-mail use in class (left) and mobile browsing in class (right)

✧ It is good if it's fun.
✧ I think it is convenient.
✧ I want to use it.
✧ I think it is good and it sounds a new idea.
✧ Mobile screen makes my eyes get tired
✧ Web browsing is costly
✧ It is troublesome.
✧ If we use mobile phones, then need not go to school.
✧ What if mobile phones get out of order or lost?

Table 1. Comments from the students about the use of mobile phones in class

SYSTEM DESIGN

It is evident that Japanese learners of English are in lack of vocabulary and that with more unknown words, more difficulty the learners face in understanding English (Takanashi & Takahashi 1987). Therefore it is very important to build up vocabulary to improve one's language ability. Takeuchi (2007) proposed the concept idea called 'cyclic model of learning' (Figure 2), where 'class', in a broad sense, means not only learning in-class but also learning outside-class and it allows teachers to incorporate students' self-learning into classroom activities (Sumi & Takeuchi 2008).

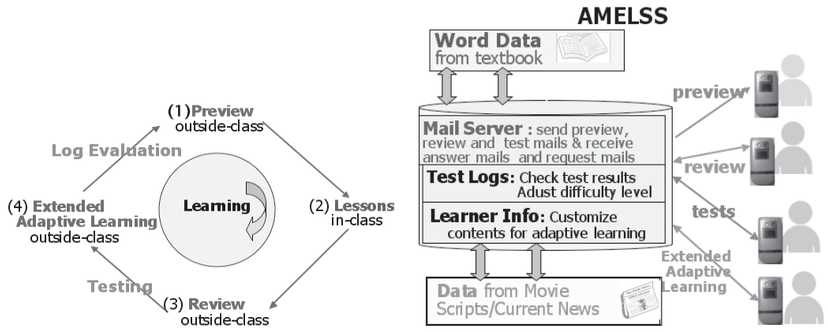

Figure 2. Cyclic Model of Learning (based on Takeuchi 2007) Figure 3 Overview of AMELSS

Based upon these ideas, we design the following adaptive mobile-based English learning support system (hereafter we call it AMELSS) (Figure 3). In our system, (1), (3) and (4) in Figure 2 are mobile-based learning. (1) and (3) are push-mode adaptive learning and (4) is request-mode adaptive learning. **Word Data** in Figure 3 consists of OCR scanned word data from the textbook to be used in class. The students are divided into groups according to the difficulty level (1,000 word level, 3,000 word level, 5,000 word level) (see Nation 2001: 416-424). **Mail Server** delivers automatically HTML preview and review e-mails. Preview and review words are chosen for each learner according to their pre-test results. **Test Logs** consist of all the tests done by the students. In this adaptive system, all the students' activities are monitored and their responses (test results) are analyzed and evaluated. This newly gained information is used to adjust difficulty levels and facilitate their learning processes. **Learner Info** contains pre-test results, which show learners' English levels, and questionnaire results which show learners' preference or their field of interest such as sports, music and so on so that customized mail contents can be delivered at stage (4) Extended adaptive learning in Figure 2. **Data from Movie Scripts/Current News** is for stage (4). The system is designed to be able to access some RSSs of several movie script websites and news websites.

The procedures shown in Figure 1 are as follows. Students are beforehand given pre-tests of English vocabulary from textbook word data and questionnaires to gain learner information on English levels and personal preference fields.

Stage (1): Mail server automatically delivers customized preview e-mails before class (cf. Figure 4). Each mail contains target words/phrases to be learned in the next class. The students are asked to answer multiple-choice quizzes.

Stage (2): The system reports the preview test results and the instructor will then focus on words mistaken by many students during class. In the scanned textbook, target words/phrases are hyperlinked and when the teacher clicks them, new windows will be opened and they show names of the students who made wrong answers (cf. Figure 5).

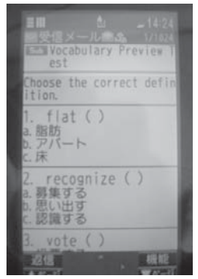

Figure 4. Preview e-mail (image)

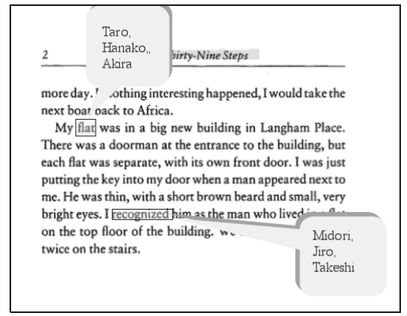

Figure 5. Textbook with hyperlinks (image)

Stage (3): Students receive review mails with quizzes and answer them by returning mails. If they answer wrong, they will keep receiving quiz mails until they make a correct answer. The system reports the review test results with most frequently mistaken word/phrase ranking lists and the instructor will review these words in the next class.

Stage (4): Students request extended adaptive learning contents by sending blank e-mails, then receive their favorite contents with word quizzes from the contents. Since this is a request-mode based, this stage is mainly for fast learners. To urge the students to go on to Stage (4), they are informed that their extended learning logs reflect their grade points.

Teachers analyze the students' learning logs: how often and how long they use it and how well they do in the tests, then evaluate accordingly. Table 2 shows one example of mail delivery schedule. Since the system is adaptive, the students who make no mistakes in review quizzes will go on to extended learning stage faster than others.

Day 1: Preview Day 1	Preview mail of target words/phrases with multiple-choice quiz (push mode)
Day 2: Preview Day 2	Preview mail of target words/phrases with multiple-choice quiz (push mode)
Day 3: Lesson Review Day 1	Class Learning: focus on most mistaken words/phrases Review mail of target words/phrases with multiple-choice quiz (push mode)
Day 4: Review Day 2	Review mail of target words/phrases which were answered wrong in the previous mail (push mode)
Day 5: Review Day 3	Review mail of target words/phrases which were answered wrong in the previous mail (push mode)
Day 6: Extended Adaptive Learning 1	Adaptive Learning : Customized Contents with target words/phrases and more (request mode)
Day 7: Extended Adaptive Learning 2	Adaptive Learning : Customized Contents with target words/phrases and more (request mode)

Table 2. Mail Delivery Schedule (Sample)

METHODS

Experiment 1

One may expect that more often students receive preview & review e-mails, the more reinforcement they get, and they will be able to learn more vocabulary. But is it true? In order to find out the best frequency of mail delivery, 120 university students, who are divided into 5 groups of equal English proficiency according to the pretest results, receive preview and review e-mails once, twice, 3, 4, & 5 times a day accordingly to see if any significant difference among

each group in the post test results. Difference between pre-tests and post tests of each group are also examined to see if they make any progress.

Experiment 2

In 1st language acquisition, children learn words from situation where they are actually used. Therefore situation is very important in learning language. They grasp the situation and then learn words. In other words, situation precedes words (Engel, 1978). Since it is pointed out that there is some similarity between L1 acquisition and L2 acquisition (Wode, H. 1981; Cook, V. 2000), it is important to learn words in real situation. Considering this point, we have designed Extended Adaptive Learning (Stage 4), where the system delivers contents from movie scripts or current news on the Internet to let the students learn how they are used in real situation. Our adaptive learning system can provide them with learner-specific and customized contents. In order to verify the validity of extended adaptive learning, 40 university students will be divided into two groups and a half of them will do extended adaptive learning while the other half will not to see if there will be any significant difference in vocabulary learning. Two groups will be tested after the three month trial and compared by the progress between pre- and post-tests.

CONCLUSION AND FUTURE WORKS

Our preliminary survey of 296 Japanese university students showed the 99% owned mobile phones and 100% of owners were e-mail users and that they preferred mobile e-mails to mobile web-browsing in English class. Thus with the use of mobile e-mails, the adaptive mobile-based English learning support system (AMELSS) is proposed. The purpose of the system is to compensate the lack of learning time of English in Japan and the realization of 'cyclic model of learning' proposed by Takeuchi (2007). Possible advantages of AMELSS are: 1) Its implementation is easy. 2) Unlike informal/self learning, in-class learning and outside-class learning are closely related so that learners can learn under the guidance of their teachers. 3) It compensates the lack of learning time in class. 4) It does not choose time and place so that they can learn and do the tasks anytime, anywhere. 5) Automatic mail delivery helps reduce teachers' heavy workload. 6) Customized contents help students enhance their motivation to learn more. The disadvantage of this system is that it may be unfair for the students who do not own mobile phones.

For the further development of AMELSS, the rise of interactive learning should be taken into account. One solution might be moblog to which students upload their own findings (contexts, etymology, etc.) or their photos so that they can share the knowledge, possibly can be awarded with the best moblogger by votes, who will earn additional grade points at the end of semester.

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m4Lit: A Teen M-novel Project in South Africa

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ABSTRACT

The m4Lit (mobile phones for literacy) pilot project will create a mobile novel (m-novel), published on a mobisite in English and in isiXhosa, to explore ways of supporting teen leisure reading and writing around fictional texts in South Africa, using mobile media. The story will be published serially and invite readers to interact with it as it unfolds – teens will vote on and discuss the unfolding plot, leave comments, and finally submit a written piece as part of a competition. The study will contribute to the understanding of mobile literacies, from a new literacy studies perspective.

Author Keywords

mobile phones; m-novel; teenagers; South Africa; new literacy studies; new literacies; literacy

INTRODUCTION

This paper reports the preliminary stages of the m4Lit (mobile phones for literacy) project, which will use a mobisite to publish a mobile novel (m-novel) written for South African teens, and made available in both English and isiXhosa, with the aim of exploring the role of mobile phones in teen reading and writing practices among isiXhosa speaking youth in Cape Town.

The project will focus on understanding how teenagers use Internet-enabled phones in reading fiction for leisure, how they discuss reading experiences with their peers in an online environment, and how they write and share their own story ideas. The premises for m4Lit are the following: First, internet-enabled mobile phones are already central to the many informal literacy activities of youth culture, particularly those associated with short message service (SMS) and instant messaging (IM). Second, such phones can potentially play a significant role in distribution of reading material (whether for formal education or for leisure). Third, phones can give young people in developing countries access to otherwise inaccessible reading material. Based on these premises, the m4Lit project will investigate the extent to which South African teens access the m-novel via their phones and integrate it into existing literacy practices, whether they choose to use their phones to engage in reading communities, to contribute to new participatory genres, or to develop audiences for their own creative work.

This short paper provides the background to the project, sketching the literacy and information and communication technology (ICT) landscape for teens in South Africa (SA), and describing key components of the project: the m-novel, the mobisite, and the planned research.

LITERACY PRACTICES AT SCHOOL AND AT HOME

South African schools still struggle to teach the majority of children how to read and write, particularly in ways that help them to succeed academically (Fleisch, 2008:2). Fleisch (2008) reports the findings of a range of standardised literacy tests where study after study finds severe problems with literacy teaching in all but a small minority of middle-class schools. Despite 15 years of redress for the educational inequities of apartheid, this achievement gap reflects how social class still strongly conditions poor and working-class children's under-achievement. Classroom studies of literacy practices explain that teachers' reliance on drill-based pedagogic approaches to reading give rise to a 'highly circumscribed version of literacy' (Prinsloo, 2004:302). A switch to English medium instruction in early years does not develop children's abilities to make meanings in their home languages and heavy use of phonics leaves little time for reading stories (Pluddeman, Mati and Mahlalela, 1998).

Children's introduction to literacy practices before they go to school, and those they encounter in their leisure time play an important role in their future success at school. This differential access of middle and working class children to school literacy and artefacts such as books begins at home (Fleisch, 2008:64, Prinsloo, 2004), continues during pre-school (Prinsloo and Stein, 2004) and contributes to distinctive bimodal patterns of school achievement from the foundation phase of primary school (WCED, 2004, Moloi and Strauss, 2005) through to secondary school (Fleisch, 2008:25-26). South African studies show that, although many poor families are extraordinarily committed to literacy and education, there is no easy fit between the literacy practices many children learn at home, the practices entrenched in marginal schools (where books, libraries and computers are also scarce), and those valued in elite contexts (Stein and Slonimsky,

2006, Fleisch, 2008:76). Thus literacy practices in most South African homes do not prepare children for schooling in the same way that middle class practices do, while most children's schooling sets them up to fail.

There are few studies of leisure reading among older township children. One small-scale study (Pretorius and Ribbens, 2005) of both lower-middle and working class children in grade seven and eight reports that all children enjoyed reading and had similar levels of access to newspapers at home. Nonetheless, the working class children (who attended a township school) reported little leisure reading of fiction, none had read a book at home in the previous year and few remembered their parents reading stories to them. This limited exposure to books means that learners are unfamiliar with children's literature or popular youth genres such as fantasy or comic books. A national survey found that, on average, South African children have access to about 32 books at home, but that almost two-thirds report having no books or less than five books at home (Moloi and Strauss, 2005). Such studies are primarily interested in the development of schooled literacy, and seldom consider other popular leisure literacy practices.

NEW LITERACIES

In contrast to this picture, the leisure literacy practices of wealthier teens in the global north are well documented. Studies show them reading and writing more than ever, in 'affinity spaces' (Gee, 2003) (where fans gather to discuss their favourite movies, games, or books), through blogs, in messages on social network pages, in emails and instant messages, and via mobile phones (Lenhart et al., 2008). The popularity of these new conversational genres has given rise to a 'participatory culture' where 'consumers are invited to actively participate in the creation and circulation of new content,' (Jenkins, 2006). These participatory practices and other new approaches towards literacy and digital media are often referred to as 'new literacies.'

Scholars tend to assume that all young people have access to computers, and that 'new literacies' develop through children's extensive out-of-school experience in using computers to access the Internet, digital media, and games (e.g. Snyder, 1998, Gee, 2003, Coiro, Knobel, Lankshear and Leu, 2008). In fact, these new literacies are far from universal, and there are complex relationships between local and global in digital literacy practices around the world (Snyder and Prinsloo, 2007). This becomes clear when we consider South African teens' extensive out-of-school mobile literacies.

Mobile literacies

Studies of children's 'new literacies' in the global north have yet to consider the distinct features of literacy associated with mobile phone use for the majority of the world. For example, mobile phones are discussed in only 4 of the 1315 pages of the mammoth *Handbook of Research on New Literacies*, while a case study of mobile learning focuses on an atypical experiment in mobile gaming with a PDA (Coiro et al., 2008). This is a significant gap if we consider the extent of global mobile phone use and also levels of public concern (Thurlow and Pof, 2009) about how text messaging (SMS or texting) deviates from formal usage, and claims of a supposedly deleterious effect on literacy and language use. Seen differently, mobile phones have entrenched new uses for literacy, notably the reading and writing skills associated with texting (cf. Thurlow and Pof, 2009). Evidence from countries such as Japan suggests that, in addition to short discursive exchanges with intimates, young people also use phones to read and write longer texts, or m-novels. Young female audiences have made m-novels into major commercial successes – the most popular are published in print form as well. In 2007, five out of the top 10 novels in Japan were such m-novels (Onishi, 2008).

South African mobile phone use reached 90.16 mobile phone subscriptions per 100 people in 2008 (ITU, 2009). Popular language and literacy practices are adapting to mobile use, inflected both by global standards and local linguistic features and cultural content (Deumert and Masinyana, 2008, Deumert, Klein and Masinyana, 2008). Even Internet use has a local and mobile accent. In the urban townships of SA, growing numbers of people, particularly young people, are accessing digital media and the Internet via their mobile phones (Donner and Gitau, 2009, Kreutzer, 2009). One of the factors driving this shift is a low cost mobile IM application known as MXit. According to a company representative, MXit has 15 million registered users, 13 million of whom are South African, and 49% of these are between 19-25 (Laura Hallam, 2009, personal communication, 14 August). Internet access is thus primarily assocated with IM as a variant of texting, and MXit reports that its users send 250 million messages per day. The first local mobile book was published on MXit in May 2009 – *Emily and the Battle of the Veil*, a 300 page fantasy story for teens.

This study is informed by the framework of New Literacy Studies which sees literacy not only as a technique (the ability to read and write), but as a social practice which always takes place within specific contexts, and which is implicated in relations of power and identity (cf. Street, 1993; Barton and Hamilton, 1998). For example, many South African children encounter computers only in the context of the circumscribed classroom practices associated with school literacy (Walton, 2007, Prinsloo and Walton, 2008). South African mobile literacies take on a different character because the social contexts of phone use are radically different from those of computer use. The mere presence of a technology such as mobile phones or mobile Internet will not shift cultural practices in marginal contexts and make them resemble more highly valued activities in better resourced contexts elsewhere. Cellphones can now access the Internet, but this does not mean that teens will want to use them to 'leapfrog' to elite literacy practices such as reading fantasy novels. This project investigates whether South African teens would want to use phones to read engaging fictional texts, or to write and discuss stories with their peers. From a New Literacy Studies perspective we will ask whether the m4Lit project has been able to make the right connections with existing sites for mobile youth culture, such as MXit (Bosch, 2008), and whether teens use the conversational architectures of social media to create hybrid genres combining conversational SMS-style dialogues with more extended texts of teen leisure fiction, despite possible associations with school literacies.

THE M-NOVEL

The m-novel will be aimed at a target audience of teens (14-16 years old), living in SA, who have access to GPRS-enabled mobile phones, and who want to read and write. The story will involve a number of fictitious characters whose adventures bring them face-to-face with real-life issues and who pursue popular teen activities such as graffiti, using technology and music. The story will be fun and youth-focused and avoid overt social or educational messages. A professional writer is developing the story through a series of workshops with teens. The story will run for 21 days in October 2009, with a 400 word chapter published per day. Each chapter will be written in short 'cliff-hanger' style. The core story is supplemented by extra content such as character profiles and word definitions. Every week prizes will be offered for the 'best' user comment (e.g. the most original or the best use of language) in English, isiXhosa, and text speak (or 'MXit language' as this is known in SA). Finally, readers will enter a writing competition e.g. 'In between 100 and 300 words, tell us what you think should happen in the sequel to the story.'

The m-novel will be published in English and isiXhosa. Deumert and Masinyana (2008) and Deumert et al. (2008) have shown that English-isiXhosa bilinguals make regular use of three different languages/language varieties in electronic communication (e.g. SMSes, blogs, and wall postings on social network sites such as Facebook): English, 'traditional' isiXhosa and a hybrid mixture of English and isiXhosa (closely mirroring everyday language use in the urban environment). By providing the story in at least two of the language forms used by speakers, we wished to avoid the common pitfall of constructing literacy in a multilingual society through the dominant language only (in the case of SA this would be English). The isiXhosa version will be closely modeled on 'general Nguni' and can thus also be read by isiZulu-speakers (over 40% of South Africans speak a Nguni language at home, compared to only 8% who speak English) – this will increase the national reach of the story.

THE MOBISITE

The mobisite will include features such as story chapters, comments on each chapter, user polls per chapter and on general story-wide issues, a general ''Express Yourself' wall' and a photo gallery, from which images and desktop wallpapers can be downloaded. In order to leave comments, vote, etc., users need to register with the site and create a social network-like profile page that includes basic information, status updates and a wall on which other users can write. Each of the four characters in the story will also have a profile page. The story is thus presented in a 'lite' social network environment and will investigate the notion that '[l]iteracy skills for the twenty first century are skills that enable participation in the new communities emerging within a networked society' (Jenkins et al., 2006). MXit users will also be able to access the mobisite directly from within MXit (a java application). This should widen the net of potential readers since many teens who use MXit do not browse the web from their phones.

THE RESEARCH

The m-novel will be widely marketed, but the research project will focus on responses from a group of isiXhosa speaking teenagers (aged 14-16 years) from two low-income, urban areas (called 'townships') in Cape Town. Sampling will occur by identifying areas served by schools in Langa and in Gugulethu where measures of students' academic performance fall on the lower 'bump' in the bimodal distribution graph of the Western Cape Province's literacy test scores (Fleisch, 2008:7). Such scores characterise the majority of low-income schools in the Western Cape, while middle class or uncharacteristically successful township schools are more likely to fall on the upper bump. Twenty-five teens from the catchment area around each of the schools will be identified and surveyed, all urban school-going youth who must own or have daily access to a GPRS-enabled mobile phone. Participants will be free to read the story in whichever language they prefer, and will be asked about their choices in in-depth facilitated survey interviews which will take place before and after the actual story. Survey interviews will collect data about both out-of-school and in-school literacies, and will investigate actual literacy practices associated with the use of mass media as well as print, digital and mobile literacies. We will also conduct a pre-story focus group with sixteen teachers from the two townships, and a post-story focus group with sixteen teens from the two townships. Quantification and statistical analysis will not be the only approach taken in the analysis of the data; situated understanding of literacy practices also requires an ethnographic, qualitative perspective.

Data generated through learners' use of the mobisite will reflect the activities of a broader group of readers, not only the 50 in the sample. Such data will allow us to determine usage patterns for the different versions of the story on a national scale (involving a large, non-restricted sample). The mobisite statistics will include: how many users accessed the site (in total and by chapter), language version popularity, an understanding of how many readers read the whole story or interacted by voting, commenting and discussing, and the number engaged enough to submit their own story.

REFLECTION

We are aware of two key risks, first, that the teens might not like the story, which would negatively affect uptake, and second, that the cost of mobile data access would force readers to stop reading and participating in the story.

Mobile phones are already causing a major sea change to literacy practices in SA and for the majority of the people in the world. The project findings will contribute to a broader understanding of this change, and will be informed by a developmental agenda (mobiles for literacy) as well as the new literacy studies (mobile phone use as new literacy

practices). The project itself will have relevance for educators looking for alternative tools for literacy and communication development, learners in non-traditional learning environments (e.g. those with access to higher-end mobile phones but not books) and publishers who want to explore alternative channels of publishing.

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Combatting “Whatdjaget”: Using Contract Grading in Distance Learning Courses

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ABSTRACT
The authors have collaborated on the instructional design of several distance learning courses using mobile technology. One of our consistent goals is motivating students to do their best work and to be more focused on self-improvement and learning and less on grades (e.g., “whatdjaget?”).

As a result of a recent request to write a book chapter on the topic, we collected qualitative data in courses taught in Spring 2009 and Summer 2009 regarding the effects of contract grading on our students in selected distance learning courses. These findings will be reported, as well as specific information on designing a course using contract learning/grading.

Author Keywords
Evaluation, Contract Learning, Contract Grading, Instructional Design, Independent Inquiry, Self-Motivation

INTRODUCTION
Contract grading originated during the “individualized instruction” movement of the 1970-80’s. It has been given new life due to its “fit” with distance learning courses including those with mobile learning components. The authors have used contract grading for a number of years in courses in Sociology and Foundations of Education, taught on line in a hybrid format, most recently using aspects of mobile learning technology (e.g., the use of iPods or PDAs).

DESCRIPTION
This presentation will describe the instructional design steps necessary to add contract grading to a mobile learning course. It will include analysis of student comments collected from four sections of two courses taught in a distance learning format using a contract grading option. The presentation will include references and resources for converting an electronic learning course into one with a self-motivating option (contract grading). Samples of grading contracts will be included. A recent definition (Spidell et al (2006) of the term “grading contract” is:

> an evaluation tool, either developed by the instructor or co-created with students, that allows students to choose individually the grade they would like to achieve in the classroom and then outlines specific student and instructor responsibilities needed for the students to receive the grade they have chosen.

WHY CONTRACTS?
This method was originally selected because students seemed to be much more concerned about what grade they received on assignments, than on issues such as how to improve, or how to do their best work. In some courses where content was controversial, students seemed to think parroting the instructor’s point of view was the safe way to get a good grade. The contract grading system was instituted by these authors to take the emphasis off grades and move students to a more self-directed mode of learning.

A Sample Contract
Below is a sample contract used in the graduate Foundations of Education course.

Summary of requirements for A contract

Quality participation (in class when we meet and on WebCT)

Philosophy draft and revisions

Quality participation in Design a School Activity

History timelines and reflection

Participation in Issues Presentation with group

In-Depth Paper on issue chosen above (relating the issue to philosophical, historical or social foundations perspectives) (7-10 pp)

Poster and short paper (3-5 pp) on chosen book (relating book’s content to the foundations studied in class)

Reflection paper based on journaling throughout semester

Summary of requirements for B contract

Quality participation (in class when we meet and on WebCT)

Philosophy draft

Participation in Design a School Activity

History timelines and reflection

Participation in Issues presentation with group

Annotated Bibliography on the issue presented

Issues Applied paper (A brief paper (2-3 pp) on a current issue with your commentary)

Brief summary of chosen book

Reflection paper

I reserve the right to assign + or – grades (e.g., if you contract for an A, you might receive an A+ or A-)

FINDINGS
The authors have used grading contracts in a number of courses during the past 10 years. This spring and summer (2009) we examined student feedback more systematically. We had two sections of a course in Educational Foundations (graduate) in the Spring (48 students) and one section of that same course, and a section of Gender Issues in Education (also a graduate course) in the Summer of 2009 (25 students).

State University of New York – College at Cortland distributes a standardized course-teacher evaluation at the end of every semester. Students complete a multiple choice evaluation and then have the option of written comments. The written comments are the place where contracts are often mentioned. All students do not complete the written comment section, however our experience tells us that those who are strongly positive about a course, and those who are strongly negative about a course usually write comments. Approximately 30% of the students wrote qualitative comments. Positive comments were the most common; however 20% of those responding with written comments included negative feedback. Written comments were categorized as “positive” or “negative” and then categorized into themes within those general categories. Representative comments for each theme follow:

> **Theme I: Contract grading encouraged creativity**. It has been shown that contract grading often increases students’ willingness to take risks with assignments, as they are not worrying about “what the teacher wants”. Thus assignments often take a variety of forms and appear more creative.
>
> “I loved the fact that the instructor encouraged creativity --- the presented projects were amazing”
>
> **Theme II. Contract grading allows freedom, thus students learn to be self-directing**.
>
> “The instructor motivated us to work, but allowed us a considerable amount of freedom during the course. I learned (by observation) much about deadlines, classroom structure and variety”
>
> “Due to a contract based approach, we were able to conduct our own time management. Some of us did this better than others”
>
> **Theme III. Contract grading made students THINK about the grading process.**
>
> “This course has influenced the way I analyze things, including grading”
>
> **Theme IV. Contract grading was fair.**
>
> “The course was great at having students learn on their own terms. It was reasonable and fair”
>
> **Theme V. Students did not have to worry about their grades and could spend time on doing their work**.
>
> “I loved the contract learning style. As long as I completed my assignments, I knew my grade”
>
> **Theme VI General positive comments (less descriptive) about the learning contract**.
>
> “I liked the idea of learning contracts. I wish it were an option in more of my classes”
>
> “One of the best courses I have ever taken, both in content and organization”

A few students did mention drawbacks – either personal issues or observations about their classmates:

> **Theme I. Students needed more guidance**.
>
> “I liked the idea of the contract. I would have liked a bit more guidance in what you wanted out of the assignments”
>
> “I found this type of course not giving enough direction for my learning style”

Theme II. Students found that the pace of work (busier toward the middle and end of the semester) difficult.

"The pacing of assignments was off"

Theme III. Students felt that "others" in class were not doing enough work.

"contract grading seemed to feel, to some, like free license to do the minimum"

As previously noted, the author discusses with students the issue of contracts several times during the semester. For the past two years the author has also attended conferences where she has presented papers on the use of contracts. Her conference attendance usually provides a "teachable moment" to discuss contracts with individuals at these conferences (and with students in the classes which might be missed through conference attendance). Students often comment that they find the option of a contract useful, given their lives as full-time teachers/graduate students. They also mention the element of trust which the contract involves, and the quality of work (often higher than they usually produce) which contracts encourage. They also often comment on the quality of their peers' work – mentioning that they feel the contract brought out more, in terms of creativity, in their peers**.**

There have been several students over the past few years who have been resistant to the idea of a contract. One, for whom English was not her first language, and who was older than most of the rest of the class, felt "offended" that her instructor would offer students the option of taking a B. The two of us had many long talks – some of which may have been impeded by a language barrier which did not allow either of us to express nuances. Finally, the student opted for an A and did well, however she continued to express her concern with the concept as a whole (this may have been related to cultural differences). As has been noted, this was an unusual event.

In general, the authors' goals of moving students from focus on grades to a focus on learning seemed to be effective, however certain students had difficulty with the degree of self-direction and that issue will also be discussed.

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Designing a 3D User Interface for a Flashcard System with Android

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ABSTRACT
Flashcards are a well known and proven method to learn and memorise. Such a way of learning is perfectly suited for "learning on the way," but carrying all the flashcards could be awkward. In this scenario, a mobile device (mobile phone) is an adequate solution. The new mobile device operating system Android from Google allows for writing multimedia-enriched applications.

Author Keywords
Android, 3D User Interface, Flashcards

INTRODUCTION
This paper discusses the development of an application based on Android. The application is an interface to a flashcard system. The idea of flashcard learning is a well known and proven way of learning. In general, people write only a small amount of information on such a card, which fits easily on a mobile device screen. Additionally, almost everyone has a mobile phone with her/him therefore it is possible to learn at any time and place. To increase the level of attraction the application is design as a 3D interface.

BACKGROUND
A traditional paper based flashcard consists of two sides, where for example the first page holds the question and the second one the answer. An efficient way of using such flashcards was proposed by Sebastian Leitner in the 1970s. His proposed method, called "Leitner System," sorts and groups the flashcards according to how well you know the answer.

The mobile operating system Android from Google is based on a Linux kernel and the Dalvik virtual machine. It includes an integrated browser based on the WebKit engine, support for 2D and 3D (OpenGL ES), SQLite to store data and support for images and video. Support for GSM, EDGE, 3G, WIFI, Bluetooth, camera, GPS, etc. are highly hardware dependent.

ANDROID DEVELOPMENT AND 3D USER INTERFACE DESIGN
In order to develop an Android application, a development environment like Eclipse and the Android Software Development Kit (SDK) are required. The SDK is, like Eclipse, freely available from the project's website. The application development is done on base of the Java programming language, which makes it easy for Java developers to write an Android application. In contrast to J2ME MIDlets (Java Micro Edition, for mobile phones) all libraries to access the underlying hardware of a device are embedded.

The 3D development is based on OpenGL ES. In order to make the application more attractive and user friendly, a flashcard is designed in 3D and animated while turning around. Additionally it is possible to place beside text, other media formats such as images and videos on a flashcard. Another newly introduced idea is that flashcards do not have to be limited to a two sided card. The new application will be able to handle more than two sides. For example, a flashcard containing a question, an answer and an additional example can be visualised as three side prism.

CONCLUSION
This work is still in progress; therefore no detailed user feedback is available. Nevertheless it has shown that with the help of the freely available mobile device platform Android it is possible to develop multimedia-enriched mobile applications.

A Collaborative Story Building Game Based on a Flashcard System

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ABSTRACT
The idea of this game is to use a flashcard system to create a short story in a foreign language. The story is developed by a group of people by exchanging sentences via a flashcard system. This way, people can learn from each other without fear of making mistakes because the group members are anonymous.

Author Keywords
Language learning, flashcard

INTRODUCTION
In this game a flashcard system is used to exchange dynamically generated flashcards among a group of people anonymously. The goal of the game is to improve language learning by creating a story within a group. A disadvantage with traditional group work is that some people do not participate because they are afraid of making mistakes.

BACKGROUND
The current prototype version is realised on the client side with HTML and AJAX. The server component consists of PHP and a MySQL database. The final version will be integrated in a Java EJB Flashcard system and the client will be implemented as a J2ME application. At the moment, the simplified prototype is used to evaluate the functionality and behaviour of the client as well as the server software. In this way, it is relatively easy and possible to modify the software in order to integrate or modify functionality proposed by the test groups.

STORY BUILDING PROCESS
Group members will be collected randomly. Each group should contain at least four to five members. They will write sentences, and the aim is to build a short story in the desired language. When a group member writes and sends a sentence, the other members of the group will have a chance to dispute by proposing another version of the sentence or they can simply agree. They are only allowed to change spelling or grammatical mistakes in their proposed version. Afterwards all group members will receive a flashcard with the proposed sentence and possible corrected versions on the other side of the card. At this stage every group member has to decide which version s/he agrees on and vote for that one. The sentence with the most votes gets elected. In case of equal votes, the first submitted one wins. Every group member has to create one sentence in one cycle. Generally the game is finished after three to four cycles. For example, if the group contain five members and the story ends after four cycles then the total number of sentences in that story will be twenty. The final short story is sent to all group members, as well as to a supervisor who will perform an overall correction.

CONCLUSION
The use of mobile technology and the necessity of learning foreign languages are increasing tremendously day by day. This game is intended to provide the users with an easy and efficient way to improve their knowledge level in the desired language by using a mobile phone.

First prototype has shown:

- Game concept sounds trivial, but to control the flow of information makes it complicated
- Mobile need in addition push technology (SMS, MMS)
- Deadlock situation (user can or is not willing to respond)

CellCast Mobile Library Simplifies Just-in-Time Training for Enterprise Workers & Mobile Professionals

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ABSTRACT
Background. OnPoint Digital worked with leading content publishers from the learning industry to design, develop and deploy the market's first multi-vendor content library, providing individuals and enterprise customers alike with ready access to mobile-friendly titles they can use to improve their business acumen, accelerate performance and improve organizational practices. The CellCast Mobile Library provides business professionals just-in-time access to helpful, thought-provoking content for anytime, anywhere learning and performance support. Subscribers select/purchase/view content from their desktop using an innovative and flexible Web 2.0 portal, then download it to their smartphone or access via virtually any mobile phone. Users who complete assignments can give ratings and offer written or spoken word comments providing rich social interactions for all participants.

Methods. More than 1,000 titles from leading content publishers have been transcoded into four different mobile-friendly formats, including message and voice-based delivery to basic cellphones and rich media podcasts and videos pushed/streamed to supported smartphones. Most titles consist of business tips and management insights from recognized business/industry leaders in a variety of formats. Content collections are organized into topics such as Business Basics, Change & Innovation, Individual Development, Sales & Marketing, Personal Effectiveness, Environmental Responsibility and others. Interested buyers preview, purchase, access and download their selections to supported mobile devices quickly and easily using sophisticated select and sync functionality ensuring on-the-move mobile learning for busy professionals.

Contributions. The CellCast Mobile Library consists of three core components including (1) the CellCast Mobile Library platform, (2) a mixture of CellCast Mobile Widgets and (3) volumes of mobile-friendly content. The CellCast Mobile Library platform is an intuitive Web 2.0 interface that makes it easy for buyers to view their purchased content online, create personal playlists, rate content and sync their mobile selections down to their smartphone or access content for any basic cell phone. CellCast Mobile Widgets help to organize and manage content delivered to supported smartphone devices, including a wide array of BlackBerry handhelds, Apple iPhone and iPod touch players, and devices running Microsoft Windows Mobile 5/6 operating system. Installed Widgets provide support for selecting, searching and syncing mobile content, and even help manage integrated tests and surveys as appropriate.

Evaluation. Launched in February 2009, the CellCast Mobile Library has accumulated more than 500 individual personal and enterprise subscribers in its first 30 days of operation and customer satisfaction with the platform and content are running at above expected rates as measured by surveys. Finally, interest from existing and new content publishers has also exceeded original expectations.

Reflection. The CellCast Mobile Library is an intuitive, effective and easy to use platform for mobile learning delivery and content consumption. The Web 2.0 interface and features provide a powerful, flexible and social experience that ensures the mobile learning experience can be educational and entertaining alike and allows users to consume their selections based on personal preferences. Finally, all CellCast Mobile Library selections have proven affordable and provide ongoing tangible benefits through their presented insights and valuable business tips.

On-the-Go Peer-Mediated Resources: An Approach to Affective Mobile Learning

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ABSTRACT AND BACKGROUND

In today's increasingly technological world, people everywhere are using mobile devices to perform tasks, consume information, create content, and learn without being tied to a desk. Furthermore, emerging technologies in areas such as massive multiplayer games, wikis, and Web 2.0 Internet applications have shifted public expectations for applications and systems to become increasingly social. These emerging technologies have resulted in a growing dissatisfaction between the expectations of learners and the reality of schools and universities. A team of developers and instructional designers from Course Development and Web Services at the University of Central Florida is interested in combining the unit's online learning mission with the opportunities innate to mobile platforms and the benefits of social networks. In this regard, the team poses the following question: How can we engage learners and support both the cognitive and affective domains in the learning process in a mobile environment?

CONTRIBUTION

Our team foresees the following contributions in the development of our interactive reference application prototype for the mobile platform:

- Development of mobile learning best practices to facilitate teaching and learning that addresses the needs, expectations, and lifestyles of our students and faculty. That is, we aim to incorporate the functionality our students and faculty use in their daily lives with their mobile devices whether at their workplace, informal learning, entertainment, or other life experiences
- Gain an understanding on how the cognitive and affective domains are affected by the deliberate design of social networking features in our mobile learning application
- Gain an understanding on the role of user-mediated learning and user-authored content in the mobile platform
- Sharing of lessons learned in the development and deployment of an instructional solution in the mobile environment from the instructional design and software development perspectives
- Provide reflections and advice for further/future mobile learning endeavors

METHODS

Our methodology consists of the following:

- Delineate and investigate technical, pedagogical, and logistical considerations to establish the framework that will guide our decisions in the selection of mobile devices, instructional practices, and development of the prototype
- Develop, test, and review prototypes
- Conduct user experience sessions and surveys to gather feedback on the use of the chosen prototype from a select group of students and faculty
- Establish and facilitate individual and collective reflective processes to gather lessons learned and identify requirements for a scalable deployment of our instructional mobile application prototype

EVIDENCE

In an effort to showcase our results, we plan on presenting a prototype of the application, along with images of the application and any associated design sketches on our poster. Also, textual and graphical representation of the pedagogical, technological, and logistical framework driving our endeavor will be displayed. Other material suitable could be notable quotations from our test-group or significant advances or pitfalls we faced during the project.

Roman Villa: Exploring the Impact of Localization on Children's Learning With Mobile Devices

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ABSTRACT

This paper reports a study, which looks at the effect of localization on children's learning about a Roman Villa using context-aware mobile technology. The participants in this study were 31 children aged between 10 and 11 years old. Two context-aware programs were constructed on the topic of a Roman Villa, one designed for use at an actual Roman villa (a heavily localized version) and the other for use in an open field unrelated to the villa (a lightly localized version). The pupils were tested on their knowledge of the Romans before and after using the context-aware programs. The results of this study show that the children who used the heavily localized version had learnt more after the experience than children who used the lightly localized version. These findings are explained in terms of the greater authenticity of the heavily localized system.

Author Keywords

Handheld Devices and Mobile Computing, Ubiquitous Computing, Context-Aware Computing, Augmented Learning

ABSTRACT

This paper reports a study, which investigates the effect of localization on children's learning about a Roman Villa using context-aware mobile technology. Context-aware programs differ in terms of the relationship between the location and the content of the learner program. Klopfer (2008) describes this as the localization spectrum, which describes how tightly the programs are connected to a particular place. This spectrum is a continuum, with lightly localized programs at one end and heavily localized program at the other end. Context-aware programs can be designed to be heavily localized or lightly localized. Lightly localized programs are highly portable and can be transported to from one place to another simply by providing new location information. This makes them more scalable and distributable by minimizing the amount of local information required to achieve this level of portability. Heavily localized programs are specific to a particular location and can include a lot of information about that location. They lead to a very tight coupling between the player, the program and the location. The cost is portability because the program cannot be moved from one location to another. The benefit is authenticity. Klopfer (2008) argues that the tighter the connection between the location, the program and the real world, the greater the potential of creating a more authentic experience. Authenticity is increased by using visual, auditory and kinaesthetic senses to enrich the experience. This sense of authenticity has a positive and powerful impact on learning. The more authentic the learning experience, the greater the learning. To date there has been no research which has investigated the impact of localization on learning with mobile devices. The aim of this paper is to report a study which investigated whether differing levels of localization influenced what students learned from a context-aware program. The expectation is that heavily localized systems should lead to greater learning than lightly localized systems. The participants in this study were 31 children aged 10 and 11. Two context sensitive programs with the same educational and information content were constructed on the topic of a Roman Villa, one designed for use at an actual Roman villa (a heavily localized version) and the other designed for use in an open field unrelated to the villa (a lightly localized version). Half the children used the heavily localized program and half used the lightly localized program. The pupils were tested on their knowledge of the Romans before and after using the context-aware programs. The test assessed their knowledge of the information that was presented on the context aware programs and thus was the same for both conditions. It did NOT assess any information that was only available to one. The study found that the children who used the heavily localized version had learnt more after the experience than children who used the lightly localized version. These findings are explained in terms of the greater authenticity of the heavily localized system.

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Mobile Technologies in Lifelong Learning: Best Practices

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ABSTRACT
MOTILL, which stands for "*Mobile Technologies in Lifelong Learning: best practices,*" is a one year project. It is funded with support from the European Commission within the National Lifelong Learning Strategies (NLLS) - Transversal programme - Key Activity 1: Policy Cooperation and Innovation of the Lifelong Programme 2007-2013. The project began on 1st March 2009. The key concepts in MOTILL are *Lifelong Learning* and *Mobile Technologies*. The MOTILL project investigates how these technologies may impact on the diffusion of a social model where learning and knowledge are accessible to all, regardless of social and economic background, age, gender, religion, ethnicity or disability. There is a need to make explicit connections between learners' (and potential learners') everyday uses of mobile devices and the use of these devices to exploit learning opportunities, whether for formal qualifications or for informal learning. The widespread use of mobile technologies in all EU countries offers an opportunity to develop policies aimed at participation and social inclusion. The use of mobile devices transcends age, social status, economic level, gender and ethnic origins. Although the education community has highlighted that mobile learning could be a suitable means to support Lifelong Learning (LLL), national policies have not yet taken any significant steps to integrate LLL and mobile technologies. The MOTILL project aims to promote this type of integration.

AIMS, RESULTS AND OUTCOMES
The project focuses on the use of mobile technologies as a key factor to develop flexible LLL frameworks for education and training. Moreover, in the long-term the MOTILL aims to involve policy makers that should sustain the strategic plans and learning activities based on the results of the project, and promote an increase in the rate of people involved in training programs. Some of the main results of the project will be:

- an up-to-date survey of the use of mobile technologies in learning and training projects in the partners' countries. This survey will also take into account policies set up in the various countries by relevant institutions;
- a methodological framework to analyse and highlight best practices. This framework will identify key factors to assess and the main indicators to consider, and will establish the principal criteria for constructing an evaluation grid;
- an open space for public discussions, involving public and private institutions, research centres, educators, and trainers, on the impact of Information Society Technologies (IST) on the future of LLL.

The project will collect, organize and analyze pedagogical approaches that exploit mobile technologies for LLL, and there will be some related activities. In particular, the project will produce a MOTILL Web Portal aimed at supporting knowledge construction and sharing of common experiences. A Scientific Annotated Review Database, i.e. an annotated repository, will bring together projects, key experiences and scholarly studies concerning LLL experiences using mobile technologies. Moreover, a Best Practices Collection will draw together national m-learning projects examined from different points of view. This collection will aid the determination of the impacts of various mobile LLL projects on participation and social inclusion policies. Users will be able to search for specific best practices or add the description of a new project, highlighting main strengths and weaknesses. The MOTILL Web Portal will use a common methodological framework implemented via an evaluation grid. Finally, project reports, concerning methodological aspects, national policies, and technical results about the use of mobile technologies in LLL initiatives will be produced.

THE PROJECT PARTNERSHIP
The institutions of the consortium play a key role in research, evaluation and application of new technologies for LLL. In particular, the project partnership involves four countries (Italy, United Kingdom, Ireland and Hungary):

- Italian National Research Council – Institute for Educational Technology of Palermo – Italy (coordinator)
- The Open University, UK - Institute of Educational Technology;
- Trinity College Dublin (Ireland) – Crite (Centre for Research in IT in Education) Schools of Education and Computer Science & Statistics;
- Corvinus University of Budapest (Hungary) - Department of Information Systems

The Important Factors Involved in the Development of Mobile Learning Contents

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Author Keywords
Mobile Learning Movie Contents, Effect Measurement, Mobile Learning Environment, Areal Difference

ABSTRACT
This paper is a report on the findings of a study based on empirical research on mobile learning. We conducted concrete and theoretical research on the modern problem of mobile learning considering the learning environment. Although lifestyle and transportation differ in each country and area, we used an audio-visual test of contents, questionnaire surveys, and a performance test in train and room environments and then we experimented for media comparison. We have two experiments. Experiment1 is Environment comparison and experiment 2 is Media comparison. The purpose of Experiment 1 is the Information Presentation of Mobile Learning Contents Conducive to Different Learning Environments. Examinees view and listen to two contents both in a train and in the room. One is the content with captions and the other is the one without captions. After that they have a performance test and Questionnaire. The purpose of Experiment 2 is to find media which is Conducive to mobile learning contents. Examinees view and listen to 4 contents only in the train environment, and after that they have a performance test and Questionnaire.

From Experiment 1, the result of the questionnaire survey, we deduced that many of the examiners thought that the room environment was suitable for study. On the other hand, a significant main effect was not detected in both environments in the performance test. As far as distance of sight is concerned, it was clarified that examiners saw nearer in the room environment than in the train environment. It is believed that there is a difference in the results of the performance test and the questionnaire survey. The questionnaire survey evinced a difference between the environments; however, in the performance test, we found a difference regardless of whether or not there was a caption. This is because many of the examiners subjectively felt that the room environment was better for studying, although there was no difference between objective learning effects in the two environments. Although the learner studied steadily in the train environment, there were a variety of obstruction factors. We observed incompatibility in the results of the subjective evaluation and objective rating.

In Experiment 2, the effect of the different types of presentation media was not considered in the results of the performance test. It can be inferred that the effect of the caption is larger, and that it gives much more information. However, as we can see in the questionnaire survey, the existence of a lecturer, the motivation for and ease of studying show that we should increase the number of media. This measure can prevent dropouts. One of the causes of dropouts in e-learning is the sense of alienation and isolation. In mobile learning, in order to guarantee performance and to prevent dropouts, it is clear that there is a need to expand the number of media.

Considering the circumstances mentioned above, it is clear that we can maintain the performance even if the learning environment is changed by caption. Moreover, there are a lot of people who answered that incorporating other media led to a rise in the satisfaction rating and that the presence of a caption would make it easier to learn. It was suggested that there is a possibility that these measures might prevent dropouts.

The greatest problem in today's mobile learning research is that basic research has not been conducted, despite the fact that mobile learning is becoming common. There is a reason why the research has not caught up with the evolution of the device. In this research, the contents that added textual information, animation information, and tonal information were developed and evaluated.

Mobile Learning Activities to Reach Out For Young Marginalised People

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BACKGROUND

Mobile learning as a certain form of e-learning also offers certain possibilities. It is responsive to the increasing mobility of students who are carrying on conversations as nomads anytime, anywhere. Nowadays and in the future, learning does not only happen in classrooms but in virtual environments, where people have access to special learning applications at different places and organise their own personal learning process. However, few studies deal with the possibilities of this learning form for those who cannot be reached by the conventional education system. In the EU funded project ComeIn (Online Mobile Communities to Facilitate the Social Inclusion of Young Marginalised People) an international research team focuses on marginalised young people (MYP) with low economic and social background who do not take part (any longer) in education or vocational training. With a mobile learning platform the ComeIn project provides access to learning activities via mobile phones. As the empirical results of the project confirmed, almost all of the marginalised young people have their own mobile phone and they use it anywhere and anytime. In contrast, their access to different Information and Communication Technologies (ICT) and the internet is often limited, especially for girls. Most of them do not have access at home or if they have it, it is often rather available for boys. This matter of fact emphasises the importance of mobile learning via mobile phones for young marginalised people .Often they only reach a low education level and do not participate in Life-Long-Learning. Bad experiences at school further contribute to a negative attitude toward learning in general. The objectives of the ComeIn project are to reach marginalised young people with distance learning models via mobile phones and to motivate them to take part again in life long learning activities.

METHODOLGY

ComeIn carried out several face-to-face interviews with experts – academics and practitioners from different realms - and focus group discussions with marginalised young people. They were recorded for later transliteration and analysed according to a qualitative analysis approach. The interviews were conducted following guidelines, which were based on a previous desktop-research that identified relevant topics. In addition, the guidelines served as primary codes in the coding process of the transcribed conversations afterwards.

CONTRIBUTION

After finishing the analysis of needs and profiles of marginalised young people, 50 MYP from Austria and 50 MYP from the United Kingdom will take part in a pilot study. Beginning in January 2010 they will be provided with a mobile phone and will have access to the ComeIn online learning platform for four months. The two main learning contents “learn-to-learn” and “entrepreneurship” should motivate MYP to participate in the first pilot phase and give them a smooth start back into the world of learning.

EVALUATION

After the pilot phase, the ComeIn research team will gather feedback of the marginalised young people to get answers to questions like “how are they attracted by the learning application and the possibility to learn with their mobile phones”, “what kind of difficulties did they face during their personal learning process” and “were the provided technologies suitable and practicable for them”. These results are important for further research work and next steps in the project.

REFLECTION

The results of the evaluation work and outcome of project ComeIn should give a better insight into the impact of mobile learning on marginalised young people and on the motivation to participate in education, to gain additional skills and to improve their personal situation in the long term. Peer review processes within the project and regular reviews by the European Commission will monitor the project activities.

ACKNOWLEDGMENTS

Thanks to the project partners of ComeIn: ATOS (Spain), Video Cells (Israel), Inclusion Trust (UK), Dramaworks (Germany), Styrian Association of Education and Economics (Austria), METOKI (Italy).

Role Of Interactive Media In Teaching Learning Process At Higher Education

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ABSTRACT

The purpose of the present study was to assess the Role of Interactive Media in teaching learning process at the higher education level. The study was descriptive in nature and therefore a survey method was selected for the collection of data. To achieve the purpose, a questionnaire of 35 questions for 200 students and 10 teachers of Virtual University of Pakistan was constructed. After reviewing the related literature, the questionnaire was designed and filled out by students and teachers of Virtual University of Pakistan. The main important issues which were focused on in the study were interactive media, diagnostic tools, learning trends, role of teachers, impact of technology, professional growth of teachers, collaborative teaching and online conferences. The collection of data was analyzed by calculating the percentage and mean score of responses on each question of items of the questions. The major results of the study were as follows:

a) Long-term concepts must be developed first.

b) Close cooperation with lecturers in teaching methods, media designers and computer scientists is absolutely necessary.

c) The technical development of the software and hardware must be considered.

d) Solutions must be expanded and modified constantly.

Author Keywords
Interactive Media, Acoustic, Restrain, World Wide Web

GO Inquire: Exploring Mobile Learning and Geological Observational Inquiry with Elementary Students

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Author Keywords
Mobile, Phone, Location-based learning, Scientific Inquiry, Erosion, Observation, Elementary Students

INTRODUCTION

This poster session will highlight on an ongoing National Science Foundation grant research project, Geological Observational Inquiry (GO Inquire), involving the exploration and integration of phone-based mobile learning technology at the upper elementary level involving children in geological observational reasoning and inquiry about erosion processes on their school grounds. The poster relates to the location-based learning theme and applied development emphasis of the conference.

The poster session will feature results from formatively evaluating field-based testing of the use GO Inquire system with elementary students who use iPhone technologies to observe, document and then upload photographic evidence of erosion processes on the school grounds to the GO Inquire database system. Once uploaded into the system, the students are prompted to identify specific attributes of the landscape (high points, low points, hard material, soft material, etc.) to begin to reason like a community of scientists. This poster will visually demonstrate the results of this formative evaluation through synthesis of qualitative interview data with teachers and students, photographs from the classroom and video snippets of students' field-based and in-classroom experiences with this mobile technology.

METHODS

The GO Inquire project employed design research and formative evaluation methods. Design research is an emerging research approach in education (Kelly, Lesh and Baek, 2008; Bannan-Ritland, 2003) that involves systematic cycles of design, development and evaluation of technology-based learning materials that also generates knowledge about teaching and learning. The GO Inquire system has been tested in elementary classrooms and results from these formative evaluation sessions will be highlighted that include: a) separating visual from verbal responses in observational inquiry; b) the integration of phone-based mobile technology for elementary school location-based learning; and c) scaffolding observational inquiry experiences to attempt to get kids to think like scientists.

Qualitative research methods provide the basis of the formative evaluation including video documentation and analysis of children and teachers use of the iPhone as an observation and documentation tool as well as uploading, identification and collaborative understanding of the captured imagery in the classroom. Video samples, interview data and documented photos will be shared in the poster session along with the formative evaluation and design research analysis.

CONTRIBUTION

The GO Inquire system has been in development for several years with funding from the National Science Foundation. The addition of location-based mobile learning provides another layer to a rich, observational inquiry experience for students that will enhance our knowledge of upper elementary students and teachers use and integration of mobile learning technologies. Documentation of the use of this system and corresponding interviews will provide insight into teachers and students receptivity to this technology in elementary classrooms as well as information on the integration of location-based learning with mobile to promote developmentally appropriate scientific inquiry.

EVIDENCE

The conceptual framework representing the INSCIREAD instructional approach or the integration of a parallel process of science and reading inquiry strategies unique to the GO Inquire system is presented below along with a screen capture of digital imagery with localized stamping and geological reasoning prompts for students:

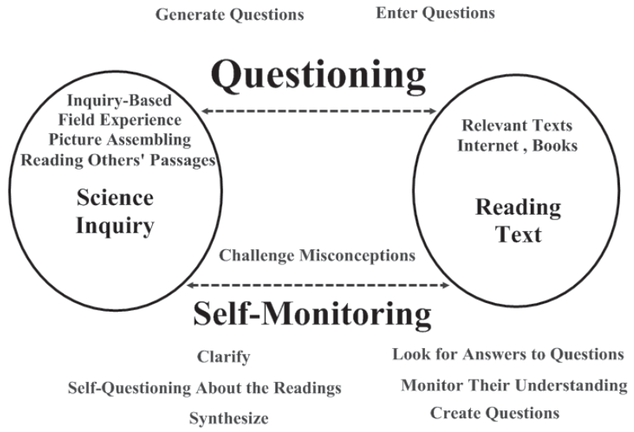

Figure 1. INSCIREAD Teaching Approach integrating Inquiry and Reading applied to Mobile Learning.

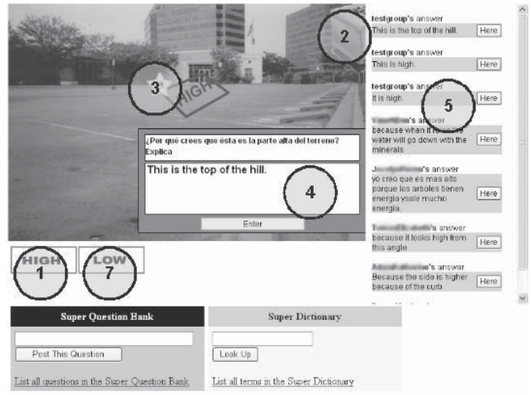

Figure 2. Screen Shot of GO-Inquire System with Digital Imagery.

CONCLUSIONS

This poster session will highlight a tested, research-based system integrating phone-based mobile learning technologies into elementary school student/teacher inquiry-based learning experiences in science. This work provides a rare perspective on how children and teachers implement mobile technologies to integrate field-based or location-based learning, geological observation and reading comprehension. Results from formative evaluation cycles in a design research context will be shared using visual photographic evidence, video components and synthesis and analysis of teacher and student interviews.

ACKNOWLEDGMENTS

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