kaleidoscope
Mobile Learning SIG

BEYOND MOBILE LEARNING WORKSHOP

Trinity College
Dublin Press

Inmaculada Arnedillo-Sánchez, Mike Sharples, Giasemi Vavoula

The CSCL Alpine Rendez-Vous

Beyond Mobile Learning Workshop

Edited by
Inmaculada Arnedillo-Sánchez, Mike Sharples, Giasemi Vavoula

Published by Trinity College Dublin Press in association with Environmental Publications with sponsoship by Kaleidoscope.

Design, layout and production by
Environmental Publications

10 digit ISBN: 1871408482
13 digit ISBN: 9781871408484

TABLE OF CONTENTS

PREFACE

In 2006 the European Kaleidoscope Network of Excellence in Technology Enhanced Learning (TEL) launched an initiative on mobile learning. It brought together research leaders from across Europe in an effort to define the field of mobile learning, to share emerging knowledge, and to explore issues arising from mobile learning projects.

Mobile Learning is a relatively new area of TEL and it has different meanings for different communities. It covers:

- learning with portable technologies, where the focus is on the technology (which could be in a fixed location, such as a classroom);
- learning across contexts, where the focus is on the learner, interacting with portable or fixed technology;
- learning in a mobile society, with a focus on how society and its institutions can accommodate and support the learning of an increasingly mobile population.

The mobile learning initiative held a two-day workshop in June 2006 in Nottingham on the topic of Big Issues in Mobile Learning. Forty researchers discussed seven themes in depth for a day each, in groups of between 8 and 13 people. The themes were:

- What is mobile learning?
- How to enhance the experience without interfering with it?
- Affective factors in learning with mobile devices.
- How can we address the conflicts between personal informal learning and traditional classroom education?
- What are appropriate methods for evaluating learning in mobile environments?
- How should learning activities using mobile technologies be designed to support innovative educational practices?
- How can we integrate mobile devices with broader educational scenarios?

The participants also held plenary sessions to survey the mobile learning landscape, presenting and debating important implications from the discussions. Their conclusions were compiled into a report of the workshop[1].

One clear conclusion was that the landscape of mobile learning is changing rapidly. Projects are moving from research, through pilot studies to implementation in classrooms, lecture theatres, museums and outdoors. Another trend is the increasing use of mobile technology to support personal and informal learning. This includes mobile versions of reference sources like Google and Wikipedia, e-books, moblogs (mobile weblogs), location-based learning (e.g. yellowarrow.net), and mobile information sharing and social networked learning.

Kaleidoscope has now supported the mobile learning initiative as a Special Interest Group. The first activity of the Kaleidoscope Mobile Learning SIG is to organise a workshop on *Beyond Mobile Learning* at the Kaleidoscope Alpine Rendezvous. The aim of the workshop is to explore new opportunities for mobile, contextual and ambient learning, through series of practical exercises and activities that take participants through a journey from present to future mobile learning enhanced by innovative technology. This report contains the abstracts of presentations for the workshop. It is both an indication of the current state of the art in mobile learning and a departure point for the journey Beyond Mobile Learning.

Mike Sharples
Coordinator, Kaleidoscope Mobile Learning SIG
Learning Sciences Research Institute, University of Nottingham

1 Sharples, M. (Ed.) (2006) *Big Issues in Mobile Learning: Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative*. Available at http://telearn.noe-kaleidoscope.org/warehouse/Sharples-2006.pdf

INTRODUCTION

Beyond Mobile Learning: two mini-workshops, one great vision

The ever increasing availability of wireless portable devices, combined with financial, logistical and technical reasons, have provided a rich environment for the proliferation of mobile learning scenarios, applications and research. Mobile Learning experiences and tools have been classified in the literature according to their educational objectives (Gay et al 2002), the activity they support (Roschelle 2003) and the educational theory that (implicitly or explicitly) underlies them (Naismith et al. 2005). More recently, Pattern et al. (2006) proposed a more extensive framework encompassing functionality and pedagogy.

The Functional-pedagogical Framework (Pattern et al. op cit.) identifies seven categories of mobile learning systems: (1) Administration; (2) Referential; (3) Interactive; (4) Micro-world; (5) Data Collection; (6) Location-Aware and (7) Collaborative. Systems in the first four categories tend to replicate learning experiences that were until recently enabled by more traditional, 'static' technology. Whereas systems in the last three categories leverage off the unique attributes of handheld devices allowing for the creation of learning opportunities which would not be possible without mobile technology.

"Beyond Mobile Learning" will set to explore the future of learning enabled by mobile technology. Through structured and exploratory activities, it will address approaches to mobile learning that go beyond merely leveraging off the mobility of the devices to replicate or augment existing learning scenarios, to focus on scenarios that attempt to create learning opportunities which would not be possible without mobile technology.

Workshop methods

A series of practical exercises and activities will take participants through a journey from present to future mobile learning enhanced by innovative technology. These hands-on activities will be structured around two mini-workshops, the first based on a Digital Narrative (DN) methodology, and the second based on the FTW method (Future Technology Workshop).

The DN methodology involves the production of a film entirely shot on mobile phones. Initially, participants generate a storyline collaboratively (facilitated by a semi-structured grounding tool). They are then divided into groups: the 'image', the 'sound' and the 'editing' group. With the 'script' (which is the output of the grounding tool) in hand to provide common ground, the 'image' and 'sound' groups go on location to shoot while the 'editing' group stays in the editing station. As the media is being captured it is automatically transferred to the editors who can start editing shortly after the 'image' and 'sound' crews have arrived on location. While shooting and editing, other communication channels are available to the participants to repair, augment and maintain the common ground if needed. By the time crew and cast are back in the editing station, the first version of the film is ready for viewing. Final editing and production take place as a whole group activity.

This hands-on activity is followed by the decomposition and analysis of the experience in relation to core learning principles and how mobile technology can support these. The method has been used over the past two years with over 250 participants ranging from teenagers in an outreach programme, young children in the Irish Museum of Modern Art, children and teenagers from the shantytowns of Cape Town, postgraduate students, school teachers and researchers among others (Arnedillo Sánchez, Tangney, 2006; McGreen & Arnedillo Sánchez, 2005).

The FTW (www.ftw.org.uk) is a structured method to actively envision and design future interactions between people and technology. The aim of this mini-workshop will be to envision and explore the relations between future learning activities and future mobile technologies. The method has been developed through the MOBIlearn (www.mobilearn.org) and Kodak Children as Photographers (www.cap.ac.uk) projects, and has been used with both children and adults on themes including 'the future of capturing and sharing images', 'future healthcare with mobile technology' and 'future informal science learning with mobile technology' (Vavoula et al. 2002, Mwanza et al. 2003, Vavoula et al. 2003, Vavoula & Sharples under review). The FTW comprises 7 sessions: Imagineering, Modelling, Role-play, Retrofit, Everyday, Futurefit, and Requirements. These make use of brainstorming, modeling, scenario building and role play to explore (1) how everyday activity is currently mediated by technology, (2) how familiar activities could be

supported by new technologies in the future, (3) what new activities could current technology support, and (4) what new activities might new technologies support in the future (see following grid).

	Current technology	Future technology
Current activity	1. Everyday technology-mediated activity	3. New activities that current technology might support
Future activity	2. Familiar activities supported by new technology	4. New activities with new technologies

The FTW will be grounded on the preceding DN workshop to explore the design of mobile technologies to support collaborative learning of media making. The FTW sessions will seek to encourage participants to reflect further on their learning about media making, on the collaborative learning practices they adopted, on related learning theories, and on the requirements for future mobile technologies to support collaborative learning in general and of media making in particular.

The two mini workshops will be stimulated by a paper presentation session, where participants will be invited to present their research interests and findings in relation to the future of mobile learning.

We hope that the workshop activities will result in a better insight into not only what future collaborative mobile learning technologies and practices might look like; but also – and perhaps more importantly – on the challenges that lie ahead researchers, designers and adopters of collaborative mobile learning.

References

Arnedillo-Sánchez, I., Tangney, B. (2006) Mobile Technology Towards Overcoming Technology & Time Constrains in Digital Video Production. In P. Isaias, P. Kommers & I. Arnedillo-Sánchez (Eds.), *Mobile Learning 2006*. Dublin: IADIS Press, pp 256- 259.

Gay, G., Rieger, R., & Bennington, T. (2002). Using mobile computing to enhance field study. *CSCL 2: carrying forward the conversation*. Koschmann, T., Hall, R., and Miyake, N., Lawrence Erlbaum Associates Inc.

McGreen, N., & Arnedillo-Sánchez, I. (2005). Mobile Phones: Creative Learning Tools. In P. Isaias, C. Borg, P. Kommers & P. Bonanno (Eds.), *Mobile Learning 2005*. Lisbon: IADIS Press, pp 213- 217.

Mwanza, D., Taylor, J., Sharp, H., and Vavoula, G. (2003) Methods for abstracting design requirements for a mobile e-Learning environment. *CALRG 2003 Conference Abstracts*, July 2-3, Milton Keynes, UK.

Naismith, L., et al. (2005). *Literature Review in Mobile Learning*. Bristol: Nesta Futurelab.

Patten, B., Arnedillo Sánchez, I., & Tangney, B. (2006). Designing collaborative, constructionist and contextual applications for handheld devices. *Computers & Education, 46(3)*, 294-308.

Roschelle, J. (2003). Unlocking the learning value of wireless mobile devices. *Journal of Computer Assisted Learning* 19(3).

Vavoula, G.N., Sharples, M., Cross, J., and Baber, C. (2003). SpyCam and RoboCam: An Application of the Future Technology Workshop Method to the Design of New Technology for Children. *Proceedings of HCI2003*, Jun 22-27, Crete, Greece. Vol. 1, pp 1071-1075.

Vavoula, G.N., Sharples, M., and Rudman, P.D. (2002). Developing the 'Future Technology Workshop' method. In Bekker, M.M., Markopoulos, P., Kersten-Tsikalkina, M. (eds.) *Proceedings of the International Workshop on Interaction Design and Children*, Aug 28-29, Eindhoven, The Netherlands, pp 65-72.

Vavoula, G.N., and Sharples, M. (under review). Future Technology Workshop: a method for the design of new technologies and activities. Submitted to *International Journal of Computer Supported Collaborative Learning*, special issue from CSCL Kaleidoscope Workshop "Methods for Evaluating CSCL".

NARRATIVE LEARNING ENVIRONMENTS AND MOBILE LEARNING: A GOOD RELATIONSHIP?

Giuliana Dettori
ITD-CNR
Via De Marini 6, 16149 Genova, Italy
dettori@itd.cnr.it

Abstract
Narrative can be a powerful aid for learning since it supports meaning making and is a natural form of expression at any age. Narrative Learning Environments (NLE) make use of meaningful stories to facilitate learning. The technology used is one of their characterizing aspects, together with the role of the user and the educational approach. This paper investigates what kind of NLE can be realized for mobile learning. A point in favour of a positive synergy is the fact that mobile learning lends itself to the creation of informal learning environments, where the use of narrative appears very natural. Some attention is in order, however, since the use of mobile technology can also lead the student to produce descriptions and chronicles, not only stories. These do not offer the same educational potential of narrative and hence give rise to different kinds of learning experiences.

Keywords
Narrative, Narrative Learning Environments, Technology

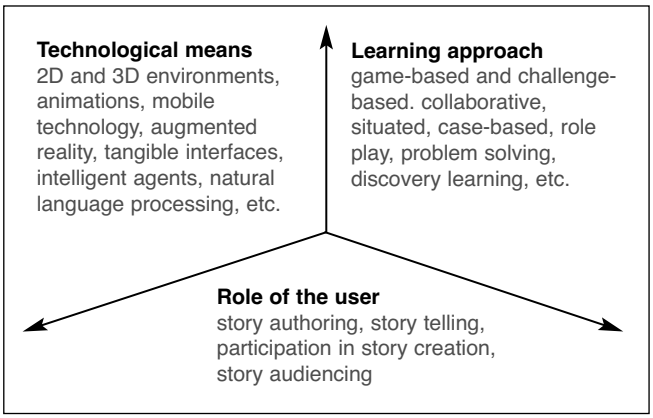
Introduction
Several studies in education carried out in the past decade have highlighted that the ability to narrate is a fundamental dimension of human thinking, which allow us to create a personal world and identity. Stories have been recognized as an important tool able to positively influence learning in its cognitive, metacognitive, motivational and emotional aspects.

Narrative Learning Environments (NLE) are technology-mediated learning environments that use stories related with the proposed task to facilitate and improve learning (Dettori et al, 2006). They are characterized by three dimensions which determine what kind of activity they allow and what kind of learning they afford: the role of the user, the learning approach embedded and the technological means (see Fig. 1). Among the variety of technological means that have been used in NLE, some influence the appearance of the environment and user interaction mode, while others determine the environment's structure and kind of narrative experience afforded. The first group includes 2D and 3D graphics, animations, sound, tactile interface. Intelligent agents, natural language processing, multimedia editors and general purpose tools, in particular communication ones like email or blogs, belong to the second group.

What determined the use of such a variety of technological resources, and consequently the development of very different NLE, is the fact that an approach to the use of narrative within learning environments was worked out independently within different research fields interested in educational issues, in particular within Artificial Intelligence (AI), multimedia studies and instructional design. Based on the specialization towards narrative of the technology used, we can devise three groups of NLE: interactive NLE (using very specialized software), multimedia (using only weakly specialized one) and environments using only general purpose software.

Interactive NLE originated from research in the field of AI. They allow the users to interact in not trivial way with the system to generate consistent narrative (Paiva, 2005), thanks to the implementation of intelligent agents and other AI techniques. Among them, we find a variety of educational computer games, virtual drama and storytelling, as well as augmented reality environments, where interaction takes place not only by using standard I/O devices but also by manipulating real objects or moving in an *ad hoc* equipped physical space. NLE which sprang from research in multimedia include hypermedia environments with narrative guidance (Luckin et al., 2001), as well as narrative editors, that is, multimedia editors explicitly (and often exclusively) oriented to the creation of stories in the form of cartoon strips (Earp & Giannetti, 2006). Finally, NLE based on general purpose software can be set up by designing some relevant narrative task within the overall design of a learning activity (e.g., De Vries, 2006, Dolk & Den Hertog, 2006). This entails educational competence and knowledge of NLE in order to plan meaningful and consistent narrative activities, well articulated with the overall learning design. This paper investigates if the use of mobile technology can be suitable for the creation of NLE. It illustrates what gives rise to the educational potential of narrative, analyses some examples of "mobile" NLE, and points out the need to carefully plan environments aiming to exploit both narrative and mobile learning.

FIGURE 1. The characterizing aspects of Narrative Learning Environments (from Dettori & Giannetti, 2006b)



NLE exploit The educational potential of Narrative

What is so special about stories to embed them into learning environments? Stories are a natural form of communication used in every culture not only by children from a very early age but also by adults. It has always been used for learning, but, until two decades ago, mostly in informal ways, leaving its systematic study to literary research. Interest for a planned and conscious use of narrative in education was raised by the work of Bruner (1986, 1990, 1996), who identified narrative as one of the two fundamental forms of human thought, the other one being logical-scientific reasoning. He pointed out that narrative captures possible formal relations among the elements of a situation before its author is able to formally explicit them. Its educational potential depends on its ability to support the construction of meaning and on the fact that is a natural way of communication at any age.

Not any text or report can be considered a story. Using Bruner's words (1990), narrative is "*a unique sequence of events, mental states, happenings involving human beings as characters or actors: these are its constituents. But these constituents do not, as it were, have a life or meaning of their own. Their meaning is given by their place in the overall configuration of the sequence as a whole- its plot or fabula*". This definition (which is very much in line with the definitions worked out in the field of narratology), and the discussion of it made by Bruner, put very precise limits on what can be called narrative and highlight on what depends its educational power, that is, on the help it gives to shape a configuration out of a sequence of events, leading to understand cause-effect relationships and characters' intentions.

NLE are learning environments that exploit this meaning-making potential by proposing, or asking to construct, stories that help the student gain a deeper understanding of the task at hand. It is clear that not all learning environments including a story can, therefore, properly be considered narrative, if the story simply aims to provide an appealing background to some unrelated learning task (Aylett, 2006). This is the case, for instance, of drill-and-practice programs where some assigned problems must be solved to progress through a story. The presence of a story in this case simply aims to motivate the learners to tackle tasks they possibly dislike and hence it does not characterize such environments as NLE.

NLE and mobile learning

Learning is an intrinsically mobile activity (Dettori & Giannetti, 2006). The diffusion of devices that allow communication among people who possibly move from place to place in the course of some (articulated) learning activity has added to it a further degree of freedom[1].

What relationship does mobile learning have with NLE? A point in favour of a positive synergy is the fact that mobile learning lends itself to the creation of informal learning environments, where the use of a natural way of making sense of events and expressing one's thoughts, like narrative, appears particularly suitable.

Does the use of mobile learning characterize NLE in any particular way? Let us consider the possible influence of mobile technology on the 3 characterizing dimensions summarized in Fig. 1. Nothing is affected as concerns the role of the user, in that all user roles are possible also in "mobile" NLE. As concerns the embedded educational approach, mobile learning obviously suggests the use of collaborative or cooperative learning activities, since the use of mobile devices emphasizes the interaction with other people. Finally, as concerns the technological means, do mobile technological tools belong to one of the groups mentioned in the Introduction, or do they suggest the opportunity to think of a fourth group of NLE? Let us see how a few examples of "mobile" NLE look like.

Walker describes two different environments created by means of narrative trails in museums (2006a) and in botanical gardens (2006b). He uses iPods (2006a) and mobile phones (2006b) to record the experiential narrations (spoken text and pictures) of several people during trips "on the field", narrations which are successively re-elaborated and shared on the web. Makrì (2006) makes use of a blog to put in touch mathematics teachers who share experiential narrations related to their

1 the acronym NLE will be used for "Narrative Learning Environments", with a plural meaning

work and improve their professional competence by this mean. Delfino (2006) underlines how narrative corners in a web-based learning environment are spontaneously created by the participants with the aim to analyse what is going on in the learning activity or to express their opinions in disguised way; she also points out that the creation of such narrative corners can be fostered by the use of metaphors and could result fruitful both to improve the sense of community and to support reflection on the learning activity. In all these cases, the technology used is not specialized for the creation of narrative (none of the mobile tools currently in use appear specialized in this sense), and the point of strength of all these environments is given by the design of educational activities apt to stimulate reflection through the creation of suitable stories. This corresponds exactly to the third group of NLE mentioned in the introduction, those based on general purpose technology, whose development requires competence to plan meaningful narrative activities and attention while carrying them out.

Is there anything to keep in mind when joining narrative and mobile in the same learning environment? Narrative is a natural form of expression, which is likely to be used in environments which make wide use of communication, but it is not the only one. With mobile technology, it is also very straightforward to produce descriptions or chronicles (e.g. by taking pictures or by recording events without suggesting cause-effect relationships and people's intentions). Descriptions and chronicles can also be valid tools for learning, but do not offer the same educational potential of narrative. Their use instead of stories gives rise to different kinds of learning experiences, and hence to environments which are not NLE. This suggests that to exploit the educational potential of narrative within mobile learning it is necessary to consciously plan the activity so as to foster the development of narrations and possibly include a phase of re-elaboration to transform other kinds of representation into narrative ones.

Conclusion

Narrative and mobile learning seem to get along well together, in that both have a flavour of informality which can lead to learn without feeling constrained. The use of narrative with mobile learning can help to give a structure to mobile learning activities. However, its is necessary to consciously plan the narrative activity in order not to risk to fail the experience.

Aknowledgement

This work was carried out within the Special Interest Group "Narrative and Learning Environments"[2] of the European network of excellence Kaleidoscope[3].

References

Aylett, R. (2006) And they both lived happily ever after? In G. Dettori, T. Giannetti, A. Paiva & A. Vaz (Eds.), *Technology-mediated narrative environments for learning* (pp.5-25). Rotterdam: Sense Publishers.

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Harvard University Press, Cambridge, Massachusetts.

Bruner, J. (1990). *Acts of meaning*. Harvard University Press, Cambridge, Massachusetts.

Bruner, J. (1996). *The culture of Education*. Harvard University Press, Cambridge, Massachusetts.

Delfino, M. (2006). Narrative corners in a web based learning environment. Presented at the *II Kaleidoscope workshop on Narrative Learning Environments*, Palermo, Italy, 26-28 June 2006.

Dettori, G., Giannetti, T., Paiva, A.& Vaz, A. (eds.) (2006). *Technology-mediated narrative environments for learning,* Sense Publishers, Rotterdam NL.

Dettori, G. & Giannetti T. (2006a) Commentary on the 3 papers on mobile learning for the ERT PTEL, *Kaleidoscope Deliverable D15-04-01*, J. Derry (ed.), pp. 22-24.

Dettori, G. & Giannetti, T. (2006b). Ambienti Narrativi per l'apprendimento. *Tecnologie Didattiche*, 37 (1), 20-27 (in Italian).

De Vries, B. (2006). Reflective narration with e-mail: Issues concerning its implementation. In G. Dettori, T. Giannetti, A. Paiva & A. Vaz (Eds.), *Technology-mediated narrative environments for learning* (pp.41-54). Sense Publishers, Rotterdam NL.

Dolk & Den Hertog (2006). Teachers' storied lives: narratives in teacher education, *Proceedings NICE 2006*, P. Brna ed., pg 13-26.

Earp, J., & Giannetti, T. (2006). Narrative-oriented software for the learning of a foreign language. In G. Dettori, T. Giannetti, A. Paiva & A. Vaz (Eds.), *Technology-mediated narrative environments for learning* (pp.27-40). Sense Publishers, Rotterdam NL.

Luckin, R., Plowman, L., Laurillard, D., Stratford, M., Taylor, J., & Corben, S. (2001). Narrative evolution: learning from students' talk about species variation. *Internat. Journal of Artificial Intelligence in Education*, 12, pp. 100-123.

2 This definition includes in mobile learning not only activities carried out with the use of mobile phones, palmtops, iPods, etc., but also web collaborative activities, like blogs and online courses.

3 http://nle.noe-kaleidoscope.org/

4 http://www.noe-kaleidoscope.org/

Makrì, K.(2006). Design and implementation of a LE for asynchronous communication and collaboration among mathematics teachers, based on narrative principles. Presented at the *II Kaleidoscope workshop on Narrative Learning Environments*, Palermo, Italy, 26-28 June 2006.

Paiva, A. (2005). The role of tangibles in interactive storytelling, *VS 2005, LNCS 3805*, G. Subsol ed., Springler Verlag Berlin Heidelberg 2005, pg. 225-228.

Walker, K. (2006a). Story structures: Building narrative trails in museums. In G. Dettori, T. Giannetti, A. Paiva & A. Vaz (Eds.), *Technology-mediated narrative environments for learning* (pp.103-113). Rotterdam: Sense Publishers.

Walker, K. (2006b). Narrative and Mobile Learning in practice and theory. Presented at the *II Kaleidoscope workshop on Narrative Learning Environments*, Palermo, Italy, 26-28 June 2006.

COLLABORATIVE COMMUNITY-ORIENTED MOBILE LEARNING
A POSITION STATEMENT

Monica Divitini
Dept. of Information and Computer Science
Norwegian University of Science and Technology,
Trondheim, Norway
divitini@idi.ntnu.no

Eli M. Morken
Dept. of Information and Computer Science
Norwegian University of Science and Technology,
Trondheim, Norway

Abstract
In the paper we briefly point out our position with respect to mobile learning. Our research has a strong focus on collaborative learning. In the paper we outline aspects of collaborative learning that we consider central to take full advantage of mobile and ubiquitous technologies and to create new scenarios of usage. We also point out challenges ahead in terms of design, implementation, and deployment. These challenges are stemming from the assumption that innovation emerges not only as a result of design, but as a continuous process that has necessarily to involve learners in all steps.

Keywords
Community, lightweight learning tools, innovation, design

Introduction
Recently many applications have been proposed to support learning situations not possible to support with traditional computer-based applications, as for example learning in the field. However, in mobile and ambient learning focus has mainly been on the access to learning resources and the research field has been deeply influenced by the paradigm of "access anytime anywhere" that has characterized early research in all areas of mobile computing. Even when communication and collaboration are supported, this is mainly limited to small groups working on specific tasks.

If we want to realize the vision of mobile learning, new metaphors and foci are needed. In this perspective the notion of learning communities, ecologies, geographies can help to open new spaces of possibility, acknowledging and supporting the processes of collaborative knowledge creation that take place thanks to the interaction with different actors outside the performance of detailed tasks. We also believe that there is a need to acknowledge that learning comes often from *exploration*, *interaction*, and *serendipity*, and not only within structured learning activities.

While the Internet has focused on distance education and collaboration among geographically distributed people, mobie and wireless services allow local issues to be brought back into the picture. They recognise the critical role of place and local communities in learning, supporting not only interactions with others around the world, but also – and, perhaps more importantly, with people nearby. Groups of people using these tools will gain new forms of social power, new ways to organize their interactions and exchanges just in time and just in place. (Rheingold 2003) The challenge is therefore to design what Thackara calls new geographies of learning, "configurations of space, place, and network that respect the social and collaborative nature of learning – while still exploiting the dynamic potential of networked collaboration". (Thackara 2005)

Our position is based on our ongoing effort within two national projects. The MOTUS project (http://www.idi.ntnu.no/~divitini/MOTUS2/) aims to investigate, through prototyping and empirical studies of overall usage, the potential and impact of mobile applications for supporting new forms of cooperation in the educational settings, independent of the participants' location (Divitini et al. 2006). Within this project we work closely with three user groups, all three at the university level: students of customer-driven software engineering courses, students of the teacher education programme (Morken et al. 2005), and language students (Petersen et al. 2005). The second project, FABULA (http://www.idi.ntnu.no/~divitini/FABULA/) aims at developing novel principles and technical solutions for learning enabled by seamless roaming in mobile networks, with focus on services that foster the city learning geographies and ecologies and enable new relationships among learners and communities.

These projects share a common concern: the need to understand better *mobility* and *cooperation* in learning settings as a way to trigger innovation. First, we believe that in mobile learning putting the focus on mobile technologies is misleading. To provide a real benefit, we have to focus on the mobility of the students, not of the technology. Though PDAs and mobile phones do offer a number of possibilities, it is only a deeper understanding of the different forms of mobility of students that can help us to fully exploit these possibilities. It is only appreciating the complexity of mobility in learning situations and the

multi-faced nature of it that we can develop technologies that promote rather than hinder learning.

Second, we need a better understanding of the notion of cooperation in learning contexts. Many existing applications tend to focus on small groups of students performing specific tasks. However, we also know that collaboration takes place within collaboration structures characterized by a looser coupling. We believe that, considering mobility of students, support for learning cannot neglect issues connected to participation to multiple communities, and how mobility across communities can hinder or foster learning. This choice finds a clear grounding in theoretical backgrounds that look at learning as situated and, as such, relates to learning as participation in communities of practice, i.e. "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis." (Wenger et al. 2002, p. 4). We however feel that the metaphor of community is not always adequate and other metaphors might be needed.

Focus within collaborative learning

In this section we elaborate on our focus within collaborative learning, pointing out issues that we consider critical for applications in the area of mobile learning.

2.1 Lightness

We have recently witnessed a growing adoption within educational contexts of lightweight tools. Blogs are used to help students to develop literacy skills, but also to support collaborative knowledge creation and the feeling of community among students (Dron 2003; Higgins et al. 2004); chat and messaging systems are used by students to keep in contact with others; SMS has dramatically changed the way students coordinate their work, especially in the context of group-based projects. The usage of these tools is often advocated as a democratic answer to Learning Management Systems, which are generally based on a closed and centralized model of knowledge. On the contrary, these tools generally support bottom up knowledge creation and easily adapt to different learning practices and needs. In addition, they are easy to install, configure, and use. This implies that their adoption does not require commitment at the organizational level. In this way, lightweight tools empower students and teachers, allowing them to find the better support for their specific needs. We strongly believe that tools empowering learners are essential to promote creativity and innovation.

2.2 Sociality

Applications in the area of collaborative computing often focus on collaboration among small groups performing a specific task, for example a group of students working on a common document. Though this perspective is central, it is also important to look at other forms of collaboration, as we pointed out in the Introduction. In particular, the feeling of being connected to each others is critical within communities for sustaining membership and belonging (IJsselsteijn et al. 2003; Rettie 2003). In mobile learning there are a number of factors that might negatively impact on how much the members of a community feel connected, such as geographical distribution, mobility, distribution of competencies and knowledge. Applications that focus on fostering social interactions have lately proved able to overcome some of these difficulties (Farshchian 2002). For examples, a growing number of web sites are used to sustain distributed communities. Chat and messaging tools can help people to keep in contact and promote social awareness. However, these applications have a number of limitations, such as limited support for mobility and participation to multiple communities. Feeling disconnected not only impacts on social well-being, but also, and most importantly, on the processes of sharing experiences and reflection that are critical to the learning process (Schön 1983).

2.3 Contamination between the physical and the virtual

Support for mobile learning must take into account students mobility and the way it impacts on the interaction with other actors of the learning experience. This includes the need to strengthen the interactions among physically collocated communities as well as creating virtual arenas to nurture the geographically distributed ones. Moreover, students' experiences are situated both socially and physically. Applications that de-contextualize the interaction with other learners are therefore problematic.

Research in the area of mobile learning has often focused on the usage of mobile technologies. However, research in the field of ubiquitous computing, ambient intelligence, and groupware put the focus on the spaces that are inhabited by users and the support that can be provided by enriching these spaces; see e.g. (Turner et al. 2005). We believe that mobile learning requires the adoption of different types of support, taking full advantage of the contamination of virtual and physical environments. This implies that support must be provided not only though mobile personal devices, but also by enriching the physical environments that are inhabited by communities. For example, shared display systems have been recently advocated as a novel technology for supporting collaboration (O'Hara et al. 2003) and they have been used also within education contexts (Brodersen et al. 2005; Jansen et al. 2005). As pointed out in Luff et al. (1998), a combination of shared displays and mobile devices can be used to support different degrees of mobility and a smooth switch from individual to collaborative activities, from public to shared information.

Promoting innovation: challenges

Mobile learning is a relatively new area and it has proved difficult to envision scenarios that fully take advantage of the space of possibilities opened by new technologies. We believe that innovation in this area requires rethinking the way we design, develop, and deploy technological support.

3.1 The design challenge

In mobile learning we need to put users (any person who participates, with different roles, to the learning process) at the centre of the design process. Putting users in focus requires understanding their needs, directly involving people with different roles in the selection, adaptation, or design of the technological support. However, we are also aware that it is often difficult for people to imagine new scenarios of use as the ones enacted by new technologies. We think that it is therefore important for technologists to take a proactive attitude and promote a discussion among users around specific devices and the possibilities that they open. The difficulties of envisioning challenging scenarios and promote innovation exploiting emerging technologies is not specific of mobile learning. This struggle has largely characterized the general field of interaction design in the last decade. Proposed solutions include, just mentioning a few, the usage of scenarios (Iacucci et al. 2002), the usage of cultural (Gaver et al. 1999) and technological (Markopoulos et al. 2006) probes, the involvement of people with different backgrounds in the process, as in the case of seductive design (Agostini et al. 2000).

Mobile learning arises a number of additional challenges because it requires to look for innovation within the framework of given pedagogical objectives, that must always come first.

3.2 The infrastructural challenge

In mobile learning there is, we believe, not only a need to build innovative applications, but also to provide a technological infrastructure that supports the rapid development of learning services and their deployment, promoting grass-root innovation. In fact, designing systems that satisfy the varying and dynamically changing needs of learning communities is challenging. Different communities might have different ways to perform similar activities, different contexts might promote completely different learning experiences even when trying to fulfill similar pedagogical objectives. Though a system might function well at a certain point in time, it might not necessarily be able to evolve with the community or with the rapid development of mobile and embedded devices. It is important therefore to design learning systems that are not monolithic entities, but are rather a dynamic and contextualized composition of services satisfying specific needs. In this perspective one of the challenges ahead is to look at commonalities among different learning contexts to identify basic services that can then be combined, possibly by end-users, to provide more complex support.

The conceived infrastructure should be flexible enough to support roaming in different networks. This is necessary for the seamless integration of different learning experiences, e.g. the ones supported by peer-to-peer interaction, the ones based on global access, and the ones possible thanks to enriched physical spaces. This is not only a technological issue since a number of experiences reported in the literature show that different underlying networks promote very different learning experiences with strong pedagogical implications.

3.3 The deployment challenge

Learning systems are complex socio-technical systems and their adoption requires an intricate co-evolution of organizations, communities, pedagogy, and technologies (Bruckman 2004). Support must be provided to promote this co-evolution, in the form, for example, of guidelines, tailoring facilities, end-user programming tools, pedagogical and organizational mechanisms, learning theories. In this perspective, we think that the practices of *bricolage*, *hacking*, and *improvization* identified in (Ciborra 2002) to explain information systems in organizations can be useful to get a new perspective on learning systems. However, to understand these practices we have to make sure that enthusiastic accounts of the innovation brought along by mobile learning are not associated with idealized and naïve accounts of use.

Acknowledgement

The work is partly funded by FABULA, supported by the Norwegian Research Council, and MOTUS, supported by NTNU. The authors thank the partners in these projects for their cooperation and all the members of the CO2Lab for being a continuous source of inspiration.

References

Agostini, A., De Michelis, G., Divitini, M., Grasso, M.A., and Snowdon, D. Design and Deployment of Community Systems: Reflections on the Campiello Experience, *Interacting with computers* (14:6), December 2002 2002, pp 689-712.

Brodersen, C., Christensen, B.G., Grønbæk, K., Dindler, C., and Sundararajah, B. eBag: A Ubiquitous Web Infrastructure for Nomadic Learning, *14th International conference on World Wide Web*, ACM Press, Chiba, Japan, 2005, pp. 298-306.

Divitini, M., and Haugaløkken, O.K. Mobile learning and cooperative teacher education, in: *Assuring university learning quality: cross-boundary collaboration*, Y. Fan, T.L. Hoel, A. Tjeldvoll and G. Engvik (eds.), TAPIR Academic Press, Trondheim, Norway, 2006, pp. 167-180.

Farshchian, B.A. Presence technologies for informal collaboration, in: *Emerging Communication: Studies on new technologies and practices in communication*, G. Riva, F. Davide and W.A. Ijsselsteijn (eds.), IOS Press, 2002.

IJsselsteijn, W., Baren, J.v., and Lanen, F.v. Staying in touch: Social presence and connectedness through synchronous and asynchronous communication media, *Proceedings of the 10th International Conference on Human-Computer Interaction*, Lawrence Erlbaum, 2003, pp. 924—928.

Jansen, M., Rossmanith, P., Uzun, I., and H., H. Integrating heterogeneous personal devices with public display-based information services, *3rd IEEE International Workshop on Wireless and Mobile Technologies in Education, WMTE 2005*, IEEE Press, Tokushima, Japan, 2005, pp. 149-153.

Lave, J., and Wenger, E. *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, 1991.

Luff, P., and Heath, C. Mobility in collaboration, *Computer Supported Cooperative Work*, ACM, 1998, pp. 305—314.

Morken, E.M., and Divitini, M. Blending mobile and ambient technologies to support mobility in practice based education: the case of teacher education, *4th World conference on mLearning*, Cape Town, South Africa, 2005, p. electronic.

Petersen, S.A., and Divitini, M. Language Learning: from Individual Learners to Communities" in: *Proceedings of the third International Workshop on Wireless and Mobile Technologies in Education 2005*, IEEE Computer Society Press, 2005, pp. 169-173.

Rettie, R. Connectedness, awareness and social presence, PRESENCE 2003, *6th International Presence Workshop*, Aalborg, Denmark, 2003.

Rheingold, H. *Smart Mobs - The Next Social Revolution*, Perseus Publishing, Cambridge, MA, 2003.

Schön, D.A. *The Reflective Practitioner: How Professional Thinks in Action*. Basic Books, 1983.

Thackara, J. *In the Bubble: designing in a complex world*. The MIT Press, Cambridge, MA, 2005.

Turner, P., and Davenport, E. (eds.) *Spaces, Spatiality and Technology Springer*, Dordrecht, The Netherlands, 2005.

Wenger, E. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, 1998.

FROM BROADCAST TO PODCAST

Bo Fibiger
Dept. of Information and Media Studies, Aarhus University
Helsingsforsgade 14, DK 8200 Aarhus N
bfib@imv.au.dk

Abstract
This paper will present the development from broadcasted educational television up to the actual use of streaming video and mobile units in eLearning. The paper will discuss the following topics: what can we learn from history? – and what are the new challenges and possibilities in mobile technologies?

What we can learn from history is that new technologies provide new didactic possibilities. On the other hand, most of the uses are based on remediation of former formats. Despite the possibilities for interaction and integration, most video in the screen are formatted as traditional broadcasted television.

Today the new video technologies can be labelled the three P's: production, portability, and panorama/3D. The challenge is how to develop new formats and new didactics for the integration of the new technology in learning environments.

Keywords
Television, video, mobility, interaction, integration, eLearning.

Introduction
This paper will present the development from broadcasted educational television up to the actual use of streaming video and mobile units in eLearning. The paper will discuss the following topics: what can we learn from history? – and what are the new challenges and possibilities in mobile technologies?

Body of Paper
Broadcasted national television is the genesis of television in education. Based on a project on the development of broadcasted educational programmes I made a contribution to a Danish encyclopaedia on media on educational television from the '30s to the '70s (Fibiger 1990). Broadcasted educational television was closely related to the philosophy of enlightenment, and as broadcast it was a very inflexible medium and very difficult to integrate as a didactic element in education.

In the beginning of the '70s it became possible for educational institution to have television equipment, both for recording and production. The new notion was media literacy and visual literacy, and in Denmark the first national seminar on production of video as a way to develop **visual literacy** in media pedagogy was arranged (Fibiger 1980).

In the '80s the monopoly for national broadcast was broken (in Denmark) and we got an era for new semi-professional producers in the media. In 1983 in Aarhus University we established a **university television and radio** station, and we developed new formats for a new generation of viewers/listeners with short entities to go in and out of a programme – but also new possibilities for viewers' engagement.

Inspired by people at the Open University, we also experimented with the **use of videocassettes** based on narrative structure with short entities as pearls on a row – to be accessed by winding and not seen from beginning to end. Thus, 10 years prior to the web, we worked with types of hyper structures to provide users with access to materials (Bang & Fibiger 1990).

Beside the terrestic networks, **satellites and cable** were part of the '80s. At the university of Aarhus we established an integrated network for access to data and television from each office and auditorium, and together with enterprises in the area we cooperated on access to and evaluation of the set up and educational potentials in the European based EuroSpace channel on the Astra satellite.

In the end of the '80s a new technology for video was introduced, the so-called laser disc, giving the possibility of combining presentations on a television screen and a computer screen (**interactive video**). We organised a project called VENUS (Video and Computers – Narrativity and Educational Systems) and made different learning materials on that platform. This technology replaced the **frame grapping and digital storing** at the computer, from the beginning a very expensive solution, but supplemented by **CD-ROM** a new medium for use of visuals in education (Fibiger 1993). In 1993 we saw CD-ROM as the future of multimedia in education, but from 1995 the Internet and the web became the primary platform for development of learning objects for education – and text became the central media for communication (Fibiger 1999, Bang & Fibiger 1998).

In this century the **streaming technology** has driven the development in educational television, but most of the

contributions are very traditional and are not using the potentials of the medium: the possibility for interaction and integration of codes/elements (Fibiger 2004, Fibiger 2006).

Clive Young et al. have described the development from broadcasted video to the integration of video on the screen through the three I's: image, interaction, and integration (Thornhill et all 2002). What we can learn from history is that new technologies provide new didactic possibilities. On the other hand, most of the uses are based on remediation of former formats. Despite the possibilities for interaction and integration, most videos on the screen are formatted as traditional broadcasted television. Today the three I's can be supplemented with the three P's: production, portability and panorama/3D.

The video technology and the new generations access to video production in daily life (e.g. mobile phones) makes it quite natural to use the **students own production** of video. Several Danish schools experiment with video productions based on video from mobile phones. The learners' productions can be embedded in weblogs and UTube and can be part of an environment for informal learning of visual literacy. Furthermore, we are experimenting with students' own video productions in training tacit knowledge in health care.

Mobile technology is also used as a learning tool in Danish schools as part of observations and registration (Bouvin et al. 2005; Brodersen et al 2005), and in recent years we have got access to a lot of educational programmes, not only as streamed video for the screen, but also for iPods – until now primarily based on sound. In the FlexLearn project, the mobile phone has been used for education of transport workers (Gjedde 2005). Here the mobile phone supports the need for flexible learning with a medium from daily use, and we can talk about "just in time" learning.

Very few reflections have been done on the formats for the different media or on the integration in the learning environment, at least not in Denmark. Mostly, the aesthetics and narratives from traditional television are transferred to the new media.

The last P stands for **Panorama and 3D**. 3D is well known from games, and combined with technologies from 3D panoramas, new visual learning objects can be developed. The strengths of 3D presentations are the possibilities for immersion and embodiment and this technology will create new ways of learning (not only with the brain, but with the whole body as when learning how to ride a bicycle).

Conclusion

The history of video in education can be seen as a development from focus on the image, later on supplemented with the possibilities for interaction, and in this century video is integrated in learning objects on the Internet. Today we can talk about the three P's as the central challenges in developing new ways of visual learning. We have the technology, what we need is to develop new formats and learn how to integrate the new possibilities in the didactic context.

References

Bang, J. and Fibiger B., 1990. The Television Screen as Medium for Education. *VENUS skriftserie,* nr. 4, Informations- og medievidenskab, Aarhus. http://old.imv.au.dk/medarbejdere/bfib/publ/37.pdf

Bang J. and Fibiger B.; 1998. Web and Video Conferencing in Education - a pedagogical design for distributed learning. *Proceedings BITE Conference,* Maastricht. http://old.imv.au.dk/medarbejdere/bfib/publ/60.pdf

Bouvin, N.O. et al, 2005. Tools of Contextualization:Extending the Class Room to the Field. *Proceedings of the 2005 Interaction Design and Children Conference*, CO, USA, ACM Press, (pp. 24-31)

Brodersen, C. et al,.2005. eBag: a ubiquitous Web infrastructure for nomadic learning. *Proceedings of the 14th international Conference on World Wide Web* (Chiba, Japan, May 10 - 14, 2005). WWW '05. ACM Press, New York, NY, 298-306. http://doi.acm.org/10.1145/1060745.1060791

Fibiger, B. (ed.), 1980. *Videoproduktion i undervisningen*. Nordisk Institut, Aarhus.

Fibiger, B., 1990. Undervisningsprogrammer i radio og TV. Poulsen J. et al. (eds). In *Mediehåndbogen* Gyldendal 1990.

Fibiger, B., 1993. Dimensions in Production and Study of Interactive Multimedia. Paper presented to XI. Nordiske Konferanse for Massekommunikasjonsforskning, Trondheim 1993. *VENUS Skriftserie* nr. 21. Institut for Informations- og medievidenskab, Aarhus.

Fibiger, B. (ed), 1999. *The semiotics of multimedia*. ICT Barcelona. http://semiotics.imv.au.dk/

Fibiger, B., 2004. Streaming video – tv eller computermedieret kommunikation. In Heilesen, S. (ed.): *Det digitale nærvær. Viden og design i nye medier*. Roskilde Universitetsforlag, Gylling s. 130 – 147.

Fibiger, B. and Dørup, J., 2006. Streaming video i læreprocesser, In Mathiasen, H. (ed): *Læring og it*. Aahus Universitetsforlag, Aarhus s. 129-150.

Gjedde, L., 2005. *Læringspotentialer med Mobil-læring. Flex-learn, Et innovativt projekt om fleksible mobilbaserede læringsformer.* DPU, København. ISBN: 87-7684-025-5

Thornhill et al., 2002. V*ideo Streaming: A Guide for Educational Development*. JISC. http://www.clickandgovideo.ac.uk/

AFFECT AND MOBILE TECHNOLOGIES: CASE STUDIES

Kim Issroff
Centre for Research in Education and Educational Technology
The Open University
Walton Hall
Milton Keynes MK7 6AA
UK
k.issroff@open.ac.uk

Eileen Scanlon
Centre for Research in Education and Educational Technology
The Open University
Walton Hall
Milton Keynes MK7 6AA
UK
e.scanlon@open.ac.uk

Ann Jones
Centre for Research in Education and Educational Technology
The Open University
Walton Hall
Milton Keynes MK7 6AA
UK
a.c.jones@open.ac.uk

Abstract
This position paper is concerned with mobile technologies from a particular perspective – that of affect. Jones et al. (2006), gave six reasons why mobile learning might be motivating: control (over goals); ownership; fun; communication; learning-in-context and continuity between contexts. In this paper, we will discuss these further drawing on a range of projects in a variety of formal and informal settings in order to illustrate how affect and the use of mobile technologies interact with one another.
.

Keywords
Affect, case studies, mobile technologies

Introduction
In Jones and Issroff (2007) we argued that
"Mobile technologies are an example of powerful motivational forces that we have not yet started to really understand. Their impact on how people communicate and structure their lives is constantly evolving. If we are to harness some of this impact for learning, we need to understand how people engage with these technologies in their everyday lives and why they have been appropriated so enthusiastically. We would argue that we particularly need to understand the affective factors around the use of technologies such as mobile devices, outside educational institutions, in order to harness this understanding and apply it to a number of contexts." (Jones and Issroff, 2007, page 195)

Jones et al. (2006), gave six reasons why mobile learning in informal settings might be motivating: control (over goals); ownership; learning-in-context; continuity between contexts; fun and communication;. In the remainder of the paper the first four of these are discussed in more detail. Examples from our research are used to illustrate their complexity in relation to mobile technologies.

Motivation and Mobile Technologies
Firstly, learners often find their informal learning activities more motivating than learning in formal settings such as schools where there is much less freedom to define tasks and relate activities to their own goals. The idea of **control** of learning being motivational is well known from the motivation literature and is one of the motivational features identified in Keller's (1983) model although much of the discussion in the past has been in the context of more formal learning, e.g. terms of freedom to negotiate routes through learning materials rather than to decide what to learn at all. In informal learning, when goals are set, learners are defining their own goals. There is evidence that people engage in a vast amount of informal learning (Vavoula 2004, Clough 2005) and by the very nature of informal learning, there is a strong relationship to learners' goals and interests which means that intrinsic motivation is likely to be high. There is an ongoing debate about what is included in and meant by informal learning and also a tension between informal learning and researching informal learning: the very act of investigation makes it more formal. Some of the evidence that is drawn on therefore is from learning in informal contexts rather than informal learning. Two recent studies by Clough have investigated informal learning of this kind in the area of natural history. One small study investigated the use of wireless enabled Tablet PCs for taking part in a UK national survey – BirdWatch. Participants used Tablet PCs to participate in an hour long observation of garden birds and reported back on their experience. In one strand of the study interviews with participants included a particular focus on motivation (Jones, Issroff, Scanlon, Clough and McAndrew, 2006). Although the overall task of the study was defined as taking part in the Birdwatch activity - which involved recording the number of birds of particular species that they saw within the period of an hour – the Tablet PC did support learners in also defining their own goals. Some of these goals complemented the goals of the defined task, for example one participant commented:

"You could look up the birds and the website and talk about them….I got to learn about birds……I got to play with Tablets"

Learning about birds was not an explicit goal of the activity. However, the technology itself was attractive to participants and it appears as though another goal for at least a couple of participants was to learn about using the Tablet PC. What freedom and control meant for some of these participants is being able to adapt the activities. It turned out that this was an important element for one participant in particular for whom things did not go as expected. She planned to do the activity with her family (including 6 year old twins) but was unable to get the wireless connection set up for the Tablet PC and thus could not complete the activity in the way that she had anticipated. However, rather than abandoning the task she (and the family) subverted and appropriated it and they were able to use the tablet and the internet connection on another PC. Also, no birds were observed, and so the task of observing birds was not possible to carry out – again the activity was changed and this led to unexpected but interesting outcomes:

We finally all got lined up along the window and there were NO birds…. … there is a limit to how long they (the 6 year olds) will stare at an empty garden -they were much more interested in the technology because they had been doing a lot of work on it at school. (My son) was very excited that he could… go on Google… do some of the ICT suite work he had done at school. So the learning activity they were doing actually was spelling – because of course you can't use Google unless you can spell so they would be going how do you spell Samuel Pepys – so I am starting out of the window making some notes on my tablet saying how do you think it is spelt. (female participant, working with young children, adaptive goal)

Secondly, mobile devices seem to give their users a very strong sense of control and **ownership** which has been highlighted in research as a key motivational factor. Ownership has a variety of meanings and can be both short term and long term as illustrated in the first example below. However, ownership also has implications for the ways in which technologies are used. The second example illustrates how ownership leads to appropriation i.e. people modify tools in order to ensure that they are usable in the contexts of their everyday activities and that the ways in which they use the tools redefines the activities.

A recent study on the use of Tablet PCs in schools (Twining et al., 2005) suggested that ownership was also important in this more formal context. In one of the schools, for example 'ownership' was an issue at both a micro and macro level. Both the teachers observed in this school used the tablet in conjunction with projecting on to the whiteboard. But they also passed the tablet around the classroom with each pupil or pair of pupils using it in turn. In one mathematics lesson each pupil or pair of pupils tried out an example or exercise and in a Geography lesson – which was a plenary on the topic – the teacher had adapted the TV 'Who wants to be a millionaire' game. Here each pupil was given the opportunity to answer the quiz questions. This very short period of "ownership" motivated the pupils. At the other end of the scale teacher ownership and access to the tablet was an issue. The teachers who made most use of the tablets had access to them over a period of time and could therefore take them home to work on and prepare lessons on. However, where the tablet was only available in the classroom the amount of time taken to set up the machine and synchronise work at the start of a lesson was a barrier to using the tablet.

Waycott (2004) conducted a number of studies of the use of PDAs in a number of contexts focussing on how users appropriated mobile devices as part of their own everyday work or leisure activities. The contexts she studied included visitors to a museum, workers in a energy company and academics in a university department. Waycott used activity theory as a frame to consider how participants' activities were influenced by the introduction of mobile devices and how the devices were adapted for everyday use. She established that while the use of such devices for learning had certain advantages in terms of e.g. access to resources, the introduction of the mobile device into the setting could itself bring limitations and constraints. Some of these are the physical limitations of the device, such as a small screen or usability problems. Her museum study as well as recognising the positive features of the introduction of new multimedia resources to enrich the experience of a visit, reports on difficulties in integrating the tool with other tools for note taking, and shifts in the social nature of the museum visit experience.

Thirdly, mobile devices enable learners to locate resources and information in the **context** where they are needed and used, including 'in the field' and to share this information with others. For example, the amateur birdwatcher can access websites from their mobile device, which provide identification guides (including audio and video) to support them in identifying birds at the point they need this information. Waycott's (2004) analysis of the museum visit formed part of the Melissa project (Vavoula et al. 2006) which reviewed a series of empirical studies which have implications for the conduct of mobile learning in informal science settings were examined. One particular trend which emerged was that the scope of science activities which can be connected to curriculum possibilities can be extended. Sefton-Green in a review of the potential of informal learning comments that

Teachers and other educators just simply need to know more about children's experiences and be confident to interpret and use the learning that goes on outside the classroom … we need a culture that can draw on a wider model of learning than that

allowed for at present. Secondly we need to work within various curriculum locations to develop links with out of school learning experiences on offer.
(Sefton –Green,2004, p 32)

The range of settings in which informal science can be done includes museums, field trips, and hobby activities. Considering field trips there is potential from use of mobile devices to extending learning possibilities outside the classroom, and also the possibility of securing more continuity between work inside and outside the classroom. Mobile technologies are particularly useful in blurring the boundaries in learning settings, between school and home, between school and field work settings, or other out of school settings such as museums.

We are suggesting that such learning in context has a particular immediacy and relevance which is motivating and mobile technologies support this by being available and providing access to resources in the context in which learning is taking place.

And finally, portability means that mobile devices can provide **continuity** between different settings and enable learners to 'chunk' their learning so that information or resources that have been captured in one context should be easily transported to another. Learners can therefore use these devices to plan their informal learning projects over time - suiting the episodic nature of much informal learning which is carried out in small, distributed chunks (Vavoula 2004). These features suggest that using mobiles in informal settings is potentially highly motivating. However, continuity is more complex than it originally seems as illustrated in the next example.

The Laptops used in School and at Home project is evaluating a scheme in a primary school in which all children in Year 4 (ages 8/9) have their own laptop which they use at school and at home. The scheme is partially funded by external grants but families pay £15 a week towards the costs of the laptop. The aim of the scheme is primarily to bridge the digital divide, but also to ensure that children gain the appropriate IT skills and to improve communication between the school and parents of the children.

One aspect of the evaluation has been concerned with whether or not parents feel they know more about their child's schoolwork because the laptop is used both at school and at home. Sixty percent of the parents who responded said that they feel they know more about their child's work. However, it is clear from their comments that this happens in a variety of ways:

"Bringing a laptop home every day prompts me to find out what Robert's been doing. However, he rarely shows me his school work on the laptop. It is usually a discussion."

"She is willing to share what she has done – verbally – more than before. If she is particularly proud of something it is available for us to see it – rather than it staying at school until the end of term/year"

And for other parents, the laptop has led to less interaction with their daughter:

"We used to discuss Jenny's homework with her and help her with it. Now she does it on her own without referring to us at all. Good for her independence, poor for communication and our relationship with her."

Thus we find that the continuity provided by the laptops between home and school has helped most parents to feel that they have a better understanding of their child's work. For most families the laptop provides a way of accessing the schoolwork that the child has done during the day and for one family uses the laptop as a way of stimulating their child's memory in order to discuss the work that he has been doing during the day. However, this is not always the case as represented by the last quote which shows how the individual nature and ownership of the laptop led to a decrease in communication between the child and her family.

Conclusion

We have reviewed here a number of reasons why mobile learning in informal settings might be motivating. We have related these to a number of example projects in which some of these reasons can be seen to be plausible explanations of some successful uses of mobile technology. In each case the example makes it clear that relatively simple terms such as control and ownership need considerable amplification to properly capture the significant features described. We are also clear that the list we have presented is not exhaustive. Candidate terms which we have been considering for future development include ideas such as persistence, frustration, creativity, curiosity and we are continuing to try to develop this list of reasons. We are also aware that the affective factors we have considered in this paper are solely those linked to motivation. It is important to look further at how people engage with mobile technologies in their everyday likes. One reason for this is that understanding the affective factors around the use of mobile technologies outside educational institutions can help to harness the potential of such technologies inside an educational institution, and that such information might help us design for better affective outcomes which we would argue might improve cognitive ones.

Acknowledgement

Many other people have been involved in these projects. We would particularly like to mention Canan Blake, Gill Clough, Peter Twining, Jenny Waycott and all the participants in our research.

References

Clough, G. (2005). The uses of PDAs and Smaartphones for Informal Learning, MSc Thesis, Open University

Jones, A. and Issroff, K. (2007). Learning Technologies: Affective and Social Issues, in Conole, G. and Oliver, M. *Perspectives on e-learning research*. Routledge Falmer.

Jones, A., Issroff., K, Scanlon, E, Clough, G and McAndrew, P (2006). Using mobile devices for learning in Informal Settings: Is it Motivating? Paper presented at *IADIS International conference Mobile Learning*. July 14-16, Dublin.

Keller, J.M. (1983). Motivational design of instruction. In C. M. Reigeluth (ed.) *Instructional Theories and Models: An Overview of Their Current Status*. New York: Lawrence Erlbaum Associates, Publishers, pp. 383 - 434.

Scanlon, E., Hardy, P., Vavoula, G., Lonsdale, P., Sharples, M., Beale, R. Jones, A., Mc Andrew, P., Taylor, J. *Mobile Learning in Informal Science Settings*. Kaleidoscope Deliverables. http://www.noe-kaleidoscope.org/pub/network/communities/jeirp/activity.php?wp=34

Scanlon, E., Jones, A. and Waycott, J. (2005). Mobile technologies: prospects for their use in learning in informal science settings, *Journal of Interactive Media in Education* 21(5), pp. 1-17.

Sefton-Green, J. (2004). *Literature Review in Informal Learning with Technology Outside School;* A Report for NESTA Futurelab (no 7); available at http://www.nestafuturelab.org/research/reviews/07_01.htm (accessed 21/04/06).

Twining, P.; Evans, D.; Cook, D.; Ralston, J.; Selwood, I.; Jones, A.; Underwood, J.; Dillon, G. and Scanlon, E. with Heppell, S.; Kukulska-Hulme, A.; McAndrew, P. and Sheehy, K. (2005). *Tablet PCs in schools: Case study report*. Coventry: Becta. Accessed online on 27 Aug 2005 at: http://www.becta.org.uk/corporate/publications/publications_detail.cfm?currentbrand=all&pubid=272

Vavoula, G. (2004) *KLeOS: A Knowledge and Learning Organisation System in Support of Lifelong Learning*. PhD Thesis, University of Birmingham, UK

Waycott, J, Jones, A. and Scanlon, E. (2005). Using a PDA as a learning or workplace tool, *Learning, Media and Technology*, 30(2) 107-130.

Waycott, J. (2004). *The appropriation of PDAs as Learning and workplace tools: an activity theory perspective*. Unpublished Ph.D. thesis, Milton Keynes

'MOBIMISSIONS': A LOCATIVE, MOBILE AND COLLABORATIVE EXPERIENCE USING CELLULAR NETWORKS

Lyndsay Grant
Futurelab
1 Canons Road, Harbourside, Bristol, BS1 5UH, UK
lyndsay.grant@futurelab.org.uk

Abstract
This paper reports on the research and development of a prototype mobile game developed in partnership by Futurelab and the Mixed Reality Lab at Nottingham University. The game uses mobile phone Cell ID as a location technology, enabling players to create 'Missions' (a collection of images and text), depositing them in locations around their city to be found by other players who then respond (through images and text). The game supports the creation of shared conversations situated in specific locations. Five significant themes emerged from the trials of this prototype that were particularly useful in understanding and analyzing young people's motivation in playing the game and appropriation of such technologies into their daily lives: (1) Location and mobility; (2) Time; (3) Social play; (4) Feedback and conversation; (5) Content. These themes are used to draw out implications for such technologies and experiences to form part of possible future learning experiences in formal and non-formal contexts.

Keywords
Mobile phones, young people, collaboration, cell ID, conversation

Introduction
'MobiMissions' is a new prototype project created by Futurelab and the Mixed Reality Lab at Nottingham University, developing a location-aware mobile phone game with and for young people. 'MobiMissions' takes advantage of the possibilities of using cell identification technology as a locative device now available on mobile phones. A prototype phone and website application was developed to explore the potential of this new type of location-sensitive technology for collaboration. This paper reports on the process of working with young people to develop a game, the findings of the research trials and further questions and issues raised in the design and use of locative and mobile technologies for learning.

Body of Paper
2.1. Origination of idea
This project originated through Futurelab's 'Call for Ideas' programme, which provides funding, partnerships and support to develop innovative ideas for supporting learning using digital technology to prototype stage. The Mixed Reality Lab at Nottingham University had developed a way to use cell ID technology in a project called 'Hitchers' (Drozd, et al. 2006), which they submitted to the 2005 Call for Ideas on the theme of supporting learning with digital technology for the 14-19 year old age group. They sought support and funding to explore the potential uses of this technology for learning.

2.2. Target user group
We identified young people aged 16-18 as our target user group, who were accessible through a school context but also independent enough to be moving around the city on their own, and therefore able to take advantage of the mobile potential of this technology. Through a series of informant-design workshops with these young people, we explored current uses and perceptions of mobile phone technology amongst the group. We then progressed to explore several potential uses of the Cell ID locative technology, eventually arriving at a game to allow users to interact with their location and with each other through a mobile phone application and a website. This process was intended to allow us to begin exploring new ways in which location-aware, situated and collaborative technologies can be used to create innovative experiences that exploit the affordances of the technology and engages users, rather than delivering existing curriculum content or formal teaching approaches.

2.3. Prototype experience created
The 'MobiMissions' game is based around the concept of creating "Missions" and leaving them in locations identified by Cell ID for other players to find and respond to. Missions are made up of a series of photographs and text and can be challenges, questions, requests for information, puzzles, treasure hunts, etc. A Mission is essentially a stimulus for another player to respond to. When a player has created a Mission, they drop it off, and it remains in that cell until found and picked up by another player. When finding a Mission, players can accept it, and respond to it through a series of photographs and text. Depending on the Mission, the response may be an answer, an opinion, a recommendation, a story-board, or something more open-ended and creative. The Mission is then released into a new location, where it will remain until another player finds it and accepts its challenge. As well as the mobile phone application, Missions and their Responses can be viewed on a website, where users can also leave comments for one another and rate each others'

Missions and Responses. The website also allows users to track a Mission's history and view a map of relationships between cells created by playing the game.

2.4. Context

Several recent projects (for example Ambient Wood (Rogers et al, 2002), MOBILearn (www.mobilearn.org) and audio tours at Tate Modern (Wilson, 2004) have taken advantage of the portable and location-aware properties of mobile devices to support a situated learning approach, allowing learning to happen in authentic and appropriate contexts. Research has also pointed to the potential of mobile devices in mobile computer-supported collaborative learning (MCSCL), and through creating shared conversation spaces where learners can share and interrogate their perspectives on the world. Game play research also suggests that playing games is often both an engaging and fun activity, but can be as much about a process of collaboration and social interaction as progressing within the game (Tobin 1998). In the MobiMissions project, we are exploring the potential of mobile devices to support such situated and collaborative experiences in an engaging and motivating game.

2.5. Trials

The MobiMissions game was trialled with a group of 18 young people over five weeks during October and November 2006, who were lent phones and provided with credit for the purposes of the trials. We were investigating the kinds of interactions between learners and between learners and spaces that this kind of experience and technology can support. A 'core group' were interviewed every week during the trial, interviewed other players and completed diaries of their play to provide an in-depth picture of the experience from their perspective.

2.6. Findings

Specific questions addressed during the trials concerned the public nature of creating and responding to Missions, and the relationship between on-location and online experiences. We also explored the tension between location-specific location-independent Missions, and the nature of collaboration and competition emerging within the game.

The cell identification technology is not a precise locative technology and therefore the experience included elements of randomness, surprise, and may have even seemed capricious at times. How these 'seamful' (Chalmers, et al. 2005) elements affected the experience were also explored during the trials.

Furthermore, several themes emerged as particularly significant to young people's motivation in playing the game and appropriation of such technologies into their daily lives:

Locatedness and mobility: Play was 'static', taking place in a series of separate and unconnected locations rather than fluidly moving between different locations.

Time: Play was 'immediate' and unplanned, with people creating and responding to content in their current location rather than planning for locations to visit at other times.

Social play: Existing social networks were extremely significant in the distribution of missions throughout the group, and co-located, synchronous experiences of play were regarded as more motivating and interesting than solitary play.

Feedback and conversations: Feedback and comments on content from other players was motivating and formed the start of several on and offline conversations.

Content: Open-ended content that left room for a creative response was preferred, and achieving this level of 'interestingness' was seen as more valuable than success as measured by extrinsic measures such as accumulating points.

Conclusion

The findings from the trials allow us to extend implications of these types of technologies and experiences as part of potential future learning contexts, both in formal and non-formal settings. For example, as a tool to support community formation and conversations and sharing within existing affinity groups; as a capture, record and discussion tool on field trips; or as a support for active citizenship through engaging with others around issues of local concern.

References

Chalmers, M., et al. (2005). Gaming on the Edge: Using Seams in Ubicomp Games. *Proceedings of PerGames 2005: Second International Workshop on Gaming Applications in Pervasive Computing Environments,* Munich, Germany, pp.11-18.

Drozd, A. et al. (2006). Hitchers: Designing for Cellular Positioning *Proceedings of UbiComp 2006: Ubiquitous Computing, Orange County, USA (forthcoming)*

Naismith, L., et al. (2004). *Literature Review in Mobile Technologies and Learning*. Bristol, NESTA Futurelab.

Rogers, et al (2002). *Learning through digitally-augmented physical experiences: reflections on the ambient wood project*. Equator Technical Report. http://machen.mrl.nott.ac.uk/PublicationStore/2002-rogers-2.pdf

Tobin, J. (1998). 'An American 'otaku' (or, a boy's virtual life on the net)' in *Digital Diversions: Youth Culture in the Age of Multimedia,* J. Sefton-Green (ed.) London, University College London Press.

Wilson, G. (2004) Multimedia Tour Programme at Tate Modern *Museums and the Web 2004: Proceedings*. Toronto, Canada.

CONCEPTS AND METHODS FOR INVESTIGATING LEARNER ACTIVITIES WITH MOBILE DEVICES: AN ACTIVITY THEORY PERSPECTIVE

Daisy Mwanza-Simwami
The Open University
Institute of Educational Technology
Walton Hall, Milton Keynes, MK7 6AA
United Kingdom
D.Mwanza-Simwami@open.ac.uk

Abstract
This position paper considers the appropriateness of using activity theory based concepts and methods to investigate issues surrounding learning with mobile devices.

Keywords
Mobile Learning, Activity Theory, AODM.

Introduction
The concept of learning with mobile devices is a fairly new phenomenon that requires further explorations in order to understand the benefits and effects of using this technology to support learning. In addition to this, research has shown that the use of technology in human activities introduces new forms of interactions that can disrupt and transform established social patterns and cultural practices (Sharples, 2003; Kerosuo & Engestrom, 2003; Mwanza, 2001). Therefore, research in this area should consider both conceptual and methodological aspects of using mobile devices in learning activities. Currently, there are no mutually acceptable theories and methods for investigating practices in this area (Scanlon et al., 2005).

2. Activity theory and activity oriented design methods
This position paper will consider the appropriateness of using activity theory (Leont'ev, 1981) based concepts and methods to investigate learner activities when interacting with mobile devices by addressing the following research questions:

1 How can we understand and interpret learner activities with mobile devices?
2 Is there a link or relationships between learners' use of mobile devices and learning outcomes?
3 How can we address emergent aspects of learner use of mobile devices?
4 How should we gather and analyse research data from mobile learning activities?

The main method will be the Activity Oriented Design Method (AODM) Mwanza, 2002); an activity theory based approach to studying human interactions with technology, which was developed as part of a PhD study. AODM presents a collection of four methodological tools developed from the framework of activity theory. These tools are briefly described in the Table 1.

TABLE 1: AODM METHODOLOGICAL TOOLS

METHODOLOGICAL TOOLS OF THE ACTIVITY ORIENTED DESIGN METHOD (AODM - MWANZA, 2002)	
Eight Step Model	Helps to put theory into practice by interpreting the situation being examined in terms of activity theory based elements of the model of human activity
Activity Notation	Reduces complexity in the situation being examined by facilitating decompositions or breaking down of a complex activity system into sub-activities in order to facilitate detailed investigation
Technique of Generating Research Questions	Helps to put activity theory into practice by generating research questions based on sub-activity triangles (i.e. decomposed models of human activity) that are used to support data gathering and analysis.
Technique of Mapping Operational Processes	Helps to communicate research insight by modeling inter-relations of operational processes and by modeling study findings e.g. contradictions identified in the analysis of human practices.

AODM prompts a deeper investigation into the social and cultural embeddedness of human practices so as to understand motives for using tools in human activity. AODM helps to examine learner practices whilst using mobile devices and other resources presented in a distributed virtual environment. In so doing, the study will consider how technology usage behavior relates to established pedagogical practices, also to the achievement of targeted goals and desired outcomes from learning activity.

Conclusion

The paper considers the appropriateness of using theory informed methods to examine learner practices in situations where mobile devices are used to support learning. An activity theory informed method namely AODM is proposed due to its holistic approach to incorporating underlying theoretical concepts and its structured approach to analyzing learner practices, which makes it easy to use and adaptable to various analytical situations.

References

Kerosuo, H. & Engeström, Y. (2003). Boundary Crossing and Learning in Creation of New Work Practice, *Journal of Workplace Learning* 15(7/8): 345-351

Leont'ev, A.N, (1981). The Problem of Activity in Psychology. In Wertsch, J.V., (1981)(Ed), *The Concept of Activity in Soviet Psychology: An Introduction*. M.E. Sharpe, Inc New York, USA.

Mwanza, D., (2002) *Towards an Activity-Oriented Design Method for HCI Research and Practice*. (Unpublished PhD Thesis) The Open University, United Kingdom.

Mwanza, D., (2001). Changing Tools Changing Attitudes: Effects of introducing a computer system to promote learning at work. In Dillenbourg, P., Eurelings, A., and Hakkarainen, K., (eds), European Perspectives on Computer-Supported Collaborative Learning. *Proceedings of the First European International Conference on Computer-Supported Collaborative Learning*, *Euro-CSCL '2001*, University of Maastricht, the Netherlands.

Sharples, M. (2003). Disruptive Devices: Mobile Technology for Conversational Learning. *International Journal of Continuing Engineering Education and Lifelong Learning*, 12, 5/6, pp. 504-520. Available online at www. Preprint available as 130Kb pdf file. [accessed on 29th July 2006]

Scanlon, E., Jones, A and Waycott, J. (2005). Mobile technologies: prospects for their use in learning in informal science settings. *Journal of Interactive Media in Education (Portable Learning: Experiences with Mobile Devices)*. Special Issue, eds. Ann Jones, Agnes Kukulska-Hulme and Daisy Mwanza), 2005/25. ISSN:1365-893X

MOTIVATING LEARNING THROUGH THE COMMUNITY OF MOBILE BLOG

Yinjuan Shao
yqs@cs.nott.ac.uk
Learning Science and Research Institute
University of Nottingham

Dr. Charles Crook
charles.crook@nottingham.ac.uk
Learning Science and Research Institute
University of Nottingham

Dr. Boriana Kolevas
bnk@cs.nott.ac.uk
Learning Science and Research Institute
University of Nottingham

Abstract
The aim of this research is to explore how records of individual's personal experience can be captured, collated, coordinated and made visible to others via group blog and potentially progress to mobile blogs in the interest of helping learning within the community in a new environment. Participants who are new oversea students started group blogging with an informal goal to learn about the new city and university from aspects of culture, life style, differences of teaching and learning etc. The group blog is also regarded as a reflection resource for participants and new comers afterwards. Surveys, interviews and conversations are conducted to find out people's attitudes and motivations on the trend of learning through Mobile Group Blog as an online learning community.

Keywords
Group blog, Online learning community, Mobile blog

Introduction
According to Blog, Wikipedia gives the definition of "A blog is a website where entries are made in journal style and displayed in a reverse chronological order." (Wikepedia 2006) In education, those images and texts published through blogs allows students to record and express their understanding of a subject or issue in different ways, and may offer less confident writers a way to engage with the curriculum (O'Hear 2004). Penny Garrod claimed his positive expectation that the weblog can be a place to collect and share things of interest, and a collaborative space (Garrod 2004). Similar to solo sonata eventually leading to orchestral work, explorations are made from simple personal blogs gradually to group blogs with multiple blog authors and readers forming a social learning network (Trafford 2005). Thus, a blog can also function as a collective learning journal for a group of people to share learning experiences. Law & Hvannberg also regarded blog as one of the basic components of an Online Learning Community System (Lambropoulos and Zaphiris 2006).

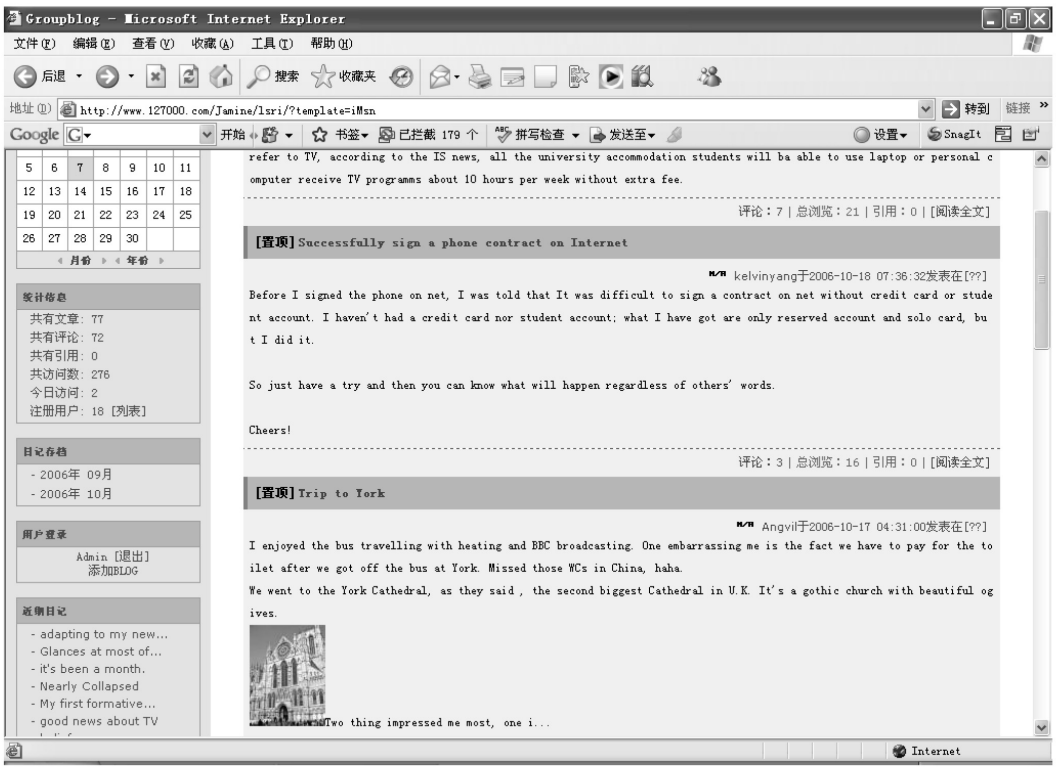
Recently, images, texts even videos with camera/video enable mobile phones can be published to weblogs on the Internet (Cheng, Yu et al. 2005). A mobile group blog is a group blog enable blogging from mobile devices such as PDAs, mobile phones and so on. Mobile blog tools could be set up for a group of learners to collect artifacts on move, attend and contribute to the salon globally , share their stories in learning in a virtual place online, discuss and get benefits from it. As reported by BBC, mobile phones captured more immediate and vivid images of blast attacks in London in July 2005(Twist 2005) and more than 1,300 posts on blogs about the blasts right after the blasts tracked by Technorati(BBC 2005).

Mobile blog can be considered as an movable online learning community which will set up new bridges of dual information exchanges among students. Betty Collis believed in the 'contributing' student who made positive contributions in a learning community by submitting new learning materials to a WWW-based system which was largely empty at the start of the learning (Collis and Moonen 2001). In addition, as well as those contributors making contributions to blogs by uploading collected data, other group members also get benefits from that community by downloading data from this group blog. Provided with mobile devices and mobile internet, the process can be finished globally and instantly.

This research also attempts to explore these learners' actual blogging activities in the community and their requirements and expectations for moblog merging the instantaneousness of electronic publication with personal point-of-view at any time anywhere.

Background
An observation by the author found that more personal blogs had been written since people started their new overseas studies in Nottingham. A group of Chinese overseas students in University of Nottingham were invited to take part in this group blog and asked to write blogs in a group blog as a learning community to record their learning and understanding about culture and life in this new environment. Personal experiences, observations, awareness and thoughts of this new environment were captured, recorded and shared by all these participants. Personal interests and attitudes toward the technology integration of mobile devices and group blog were recorded through interviews and focus group. The authors

FIGURE 1: TOPPED BLOGS IN THE GROUP BLOG



endeavor to identify the intention and motivation of these people on their work of recording and sharing their experiences through mobile group blog.

Methods

A group blog of public access[1] was supplied for 16 new Chinese overseas students in Nottingham to record their individual experiences through texts and images.

Volunteers (10 females, 6 males) ranging from 22 to 35 years old, pursuing degrees from undergraduate to PhD, were asked to keep dairy records starting one week right after their arrival and lasting for 3 weeks. Some of them didn't know each other before this research. All of them except one male had previous experiences of blogging ranging from 18 months to 2 months. Most of them have personal blogs on Msn space and some of them have experiences of group blogging.

The group blog is open to public access for viewing, but only to registered bloggers for authoring and changing. During the three weeks, 120 logins by bloggers were found, 77 articles were posted onto the group blog in forms of texts and images and 72 comments were given while total number of blog hits was 254. On average, each participant had only one activity, i.e., posting, commenting or login on the group blog within three or four days, not everyday. They shared good and bad news, their excitement on traveling and agony with difficulties in learning, their viewpoints about new culture, their life style changes in new accommodation and so on. 14 of those participants joined subsequent interviews and focus groups concerning their experiences on that group blogging after the practical cases.

Another group of 5 people who didn't join that group blog community also took part in a focus group on conversational style to discuss their experiences of blogging and mobile Internet and their needs and motivations toward mobile blogging.

Interpretation process was applied after interviews and focus groups. The conversations were recorded and notes were taken.

Findings

We found that these overseas students had great enthusiasm to share information with people locally or globally. A group blog is a good platform for record keeping, information sharing in physical world to the virtual world on the internet. Their attitudes towards mobile group blog are positive.

1 (http://www.127000.com/Jamine/lsri/)

4.1 Mobile Blog is beyond a Journal

One of the most important findings is that from people's view, a group blog or advancing to a mobile group blog is not only a journal. Blogging time is not so strict and a group blog is more like a community.

Time

In this research we found that participants were found not to blog everyday. The frequency for these group of people on writing blogs is twice a week on average. Most people write blogs at wills.

> *"I usually write blogs right after some events, not everyday" "I only write things which I think are important. It means those things worth recording"*

People didn't follow the strict schedule for blogging, sometimes they wrote more than 3 blogs in one day but wrote nothing in quite a few days.

Communication

The new word 'group blog' is born of the needs of more than one contributor who have similar intentions and topics would like to post original materials (Rossi 2006). In this community, people with the same interest on some topics may enhance the attention and encourage other. One participant in this research had the feeling that other people were 'watching' her and looked forward to her contributions. For participants, target audiences in this group blog are participants who have similar backgrounds as strangers to this place. Thus they only post relevant adaptive experiences of new life in Nottingham onto this blog to share. They believed what they had done should be useful for other people in that community or people coming afterwards.

Bloggers and readers in the group blog have both real and virtual relationship. All participants in this research are newcomers. Some of them knew each other before while others didn't. The group blog gathers people together for the same purpose and in real life enhances acquaintance among them.

> *"And you will find many similar views towards something, something in common there. I like that kind of feeling. You don't feel lonely anymore."*

Furthermore, they believed on advancing to mobile blog, this new freedom of publication blazes a new channel for more flexible communication at any time anywhere.

4.2 Roles in the Group Blog Learning Community

Observations of people's activities in that group blog revealed that, like in a real community, various roles were played by different people when they were active in the group. Learners in group blog might have three key roles when they are learning either by contributing or by reading. One person may have one or more roles at the same time.

4.2.1 Silent visitor/observer

Data of visits and logins of the group blog illustrates that people act as visitors more often. In this public group blog system, only registered users have the right to author blogs. Of all total visits, 47% are from learners logins. Moreover, only 40% of logins created blogs. That means more than half of the visits came from people who only wanted to view blogs without reactions.

However, these silent visitors got benefits from the contents of the blog. This was stated by the people who joined the focus group and interviews later on.

4.2.2 Commenter

In this group, the number of comments is slightly less than blog articles. People seem to feel more free to give comments to people they know better. Comments have strong effects on the bloggers. Positive comments will encourage the blogger to keep blogging or giving feedback.

4.2.3 Blogger

Bloggers in the group blog are active and initiative learners. They capture information in the real world and create learning materials on the blog website. They will be remote informants or information capturers in reality as well when the group blog extends to a mobile one.

4.3 Value of reflection

A blog with the feature of a journal can easily show the learning track of the blogger. When all these contributions and comments by bloggers and readers are deposited, a learning resource consists of many authentic materials and this is formed little by little. With this resource, learners in the group blog community can have reflections as follows:

4.3.1 Synchronous self-reflection

This immediate reflection happens right after the blogger finishes blogging. "I will review my blog to check errors or mistakes". For the sake of sharing information, bloggers take it as a responsibility to present right expressions for themselves.

4.3.2 Synchronous peer-reflection (mobile)

The potential extended reflection from this research towards mobile blog aims to offer real-time peer evaluations and reflections. This feature would be enabled by mobile devices when bloggers behave as readers at the same time. In other words, bloggers not only can post texts, images and even audio or video files to the blog, but also can view contributions by other instantly.

4.3.3 Asynchronous self-reflection

People also have quick reviews to their previous blogs after a while. Some participants review their own blogs before they write a new blog, some review them by acting as a vistor, some want to print their articles and images a few years later as a personal history record. With different purposes or motivations to review their own blogs people have the freedom to choose the time and place they'd like.

4.3.4 Asynchronous group-reflection

A group blog collect all records from individual bloggers. People who have the authority of this group blog entries can view all contributions all the time. Categorizing these contributions and displaying them in a logical and friendly way will increase the ease of information searching.

4.4 Points for Mobile Group blog design

With reference to some guidelines from Niki Lambropoulos (Lambropoulos and Zaphiris 2006) to facilitate interactions in the online learning community, we found the following features could be considered in designing a mobile group blog.

4.4.1 Intention

In some cases, there may be some constant learners during a short period of time in one group blog. The designers should have the awareness of different short-term and long-term learning scheme whether formal or informal. And the learning objectives and expected outcomes should be assessed prior to making decisions.

4.4.2 Information

Suggestions from participants in this research indicates that good categories and meta-tags in the Group blog are beneficial to reflections. Information categories are so important that they not only provide navigation guidance for reading and reviewing but also enable easy inputs by bloggers when authoring. Categories such as forthcoming activities, special offers, tips on trips and culture, experiences on learning etc are highly recommended. Keywords on blogs will also enhance the information searching and better navigation for reflections.

4.4.3 Control

Apart from wiki, the technology of Group Blog keeps personal preferences as well as collaboration among learners. Individuals in group blog don't have the authority to change others' blog contents but they can also contribute to the contents by giving comments. That may in some sense reduce the interactivity but on the other hand also decrease baleful antisocial behaviors.

The free use of mobile devices for blogging increases the risk of flames and discouraging uncooperative behaviors. Some may refer to more problems on privacy and security. Hence in a relatively disciplined learning community, features such as a 'police' in a group blog are crucial for maintaining and restricting improper activities on the community.

Conclusion

This research is done before the design of a mobile Group blog for a learning setting. People in this research have considerable desire for mobile blogging without regard to current technical limitations. Evidences in the group blog and conversations reveal that people expect efficient collation and collaboration among individuals by sharing instant information through mobile technology. Group blog remains unique personal styles and preferences as well as encourages collaboration and social communication within bloggers and even readers.

To "capture the moment", not only something happened but something flashed in one's mind are especially praying for mobile recording technology. The desires for immediately sharing and reviewing could result in mobile blogging for information distributing as well as information gathering. As mobile group blog application in learning is only at its infant age, more human factors and technical issues relevant to design are still on exploration.

References

BBC (2005). *Blogs respond to London blasts*.

Beale, R. (2006). Mobile blogging: experiences of technologically inspired design. *Conference on Human Factors in Computing Systems, CHI '06* extended abstracts on Human factors in computing systems Canada.

Cheng, Y.-M., W. Yu, et al. (2005). Life is Sharable: Blogging Life Experience with RFID, *Embedded Mobile Phones*. 295-298.

Collis, B. and J. Moonen (2001). *Flexible Learning in a digital world*.

Garrod, P. (2004). Weblogs: Do they belong in libraries? *Ariadne* 40 July(40).

Lambropoulos, N. and P. Zaphiris (2006). User-Centered Design of Online Learning Communities, Infromation Science Publishing (an imprint of Idea Group Inc.).

O'Hear, S. (2004). Logs prepare to go on a roll. *Education Guardian*.

Rossi, L. C. D. (2006). *Group And Multi-User Blog Platforms Compared*.

Trafford, P. (2005). *Mobile Blogs, Personal Reflections and Learning Environments*. Retrieved 13 December 2005, from http://www.ariadne.ac.uk/issue44/trafford.

Twist, J. (2005). *Mobiles capture blast aftermath*. Retrieved 24 Nov 2006, from http://news.bbc.co.uk/1/hi/technology/4663561.stm.

Wikepedia (2006).

SENSING ANOMALIES: AN EXPLORATION OF DISORGANISATION AND DISTURBANCE AS PRODUCTIVE ELEMENTS IN LEARNING THROUGH LOCATION

Juliet Sprake
Goldsmiths College
University of London
Lewisham Way, London SE14 6NW
j.sprake@gold.ac.uk

Abstract
Learning *through* location brings the changing materiality of buildings over time and the graininess of human inhabitation into focus as the physicality of the environment we move through is processed into the content of the event. This paper makes a case for disrupting prescriptive delivery models of teaching and creates a framework for proposing an alternative pedagogy focusing on mobility and spatiality in learning.

1. Disorganised learning
The first part of this paper develops a working definition of the kinds of learning web afforded by learner mobility – webs that are socially activated, rhizomatic and tactical in nature. Scott Lash (2002) argues that in the information society, ideas circulate external to the subject and this space of flow can create a space for critique. An element of his argument is that organisations are in decline and disorganisations are emerging through this decline as side effects of the process. As such, they are value co-ordinated rather than norm-led, always on the move, open to interference and invasion and participants in disorganisations are involved in activities. This paper unpicks how such a notion of disorganisation may be relevant to an emerging pedagogy in mobile learning.

2. Disturbed findings
The paper goes on to outline an idea for an urban excavation toolkit, a toolkit that draws on successful ingredients from several experimental projects to present a blueprint of innovative ways for learners to 'sense the city'. In these projects, mobile technologies enable learners to penetrate the perceived solidity of the built environment through making architextural trails. Location-aware creative research processes that have evolved from these projects are positioned as key elements of disruptive learning.

Keywords
archaeology, dispersed, mobility, spatial enquiry, built environment

Contents

List of Illustrations
(All are the author's)

Introductory thinking

> *Anomaly*: irregularity of condition, motion, behaviour
> An anomalous thing or being, an exceptional circumstance
> A disturbance from the given
> (SOED)

Learners disrupt. Mobile technologies can help to do this; devices that flatten hierarchies enable learning webs and fragment didactic information. Learners have the expertise, knowledge and skills that can change the classroom dynamic as they appropriate both the devices and the learning activity. Learning communities become dispersed as learners decide when, how and where they engage in learning and who or what can best facilitate that process. Personal storage areas have built-in privacy that the back page of an exercise book lacked. Experiences can be captured and analysed in the field and with each other, making 'stumbling upon', 'noticing' and 'connecting' key attributes of the mobile learner.

Bringing these attributes to urban archaeology[1] allows finds to co-mingle across the city's marginal spaces through dispersed diggers engaging in the randomness of finding and cluttering of collecting to create a profusion of meanings and multiple narratives. A different kind of 'museum' experience – **in situ** rather than removed to institution. Learners involved in recoding the past – foregrounding pluralities of meaning, discovering anomalies – disrupt institutionalised notions of heritage.

Mobile technologies can create conditions for both spatial contiguity and spatial dispersal that could lead to new opportunities for learning webs 'out of the classroom'; webs that are rhizomatic, enabling lateral, contingent upon connections between people, objects and places…

FIG 1

1. Part One: Disorganised learning

The first part of this paper presents the case for building an intersection between theories of space and educational pedagogy that is concerned with active learning and social change. Paulo Friere's *Pedagogy of the Oppressed* (1970) provides the theoretical backbone for writing this section; a series of key phrases are extracted from the text and investigated through a range of readings from different thinkers and disciplines that start to unpack what might be meant by interactive and participatory learning and how learning might be located 'out of the classroom'. Some of the connections made are speculative, and as such, this section is not so much concerned with the rigour of the methodology but with the outcome – a springboard for developing key ideas in the design of mobile learning projects.

'Prescription'

Friere describes behaviour of the oppressed as 'prescribed' in that it follows the guidelines of the oppressor and this amounts to the imposition of one individual's choice on another. In a sense, prescribed behaviour is not reflective, and Friere argues that this results in dehumanisation where thought is separate to reality:

> In dialectal thought, world and action are ultimately interdependent. But action is human only when it is not merely an occupation but is also a preoccupation, that is when it is not dichotomized from reflection.
> (Friere 1970: 35)

Friere makes a distinction between systematic education and educational projects. The systematic can only be changed by political power – educational projects 'which should be carried out *with* the oppressed in the process of organising them.' (Friere 1970: 36) In a later scripted conversation between Myles Horton and Paulo Friere (1990), Horton describes an alternative understanding of organisation and technical training, as one of strategic practice – developing issues rather than people:

> …there's a big difference in giving information and telling people how to use it… the use of expert knowledge is different from having the expert telling people what to do, and I think that's where I draw the line. I have no problem with using information that experts have, as long as they don't say this is what you should do. I've never found any experts that know where the line is… There's an organizational success, maybe, as a result of that, but there's no *empowerment* of people, no learning… If I'm the expert, my expertise is in knowing not to be an expert or in knowing how I feel experts should be used.
> (Horton and Friere, 1990: 130-131)

Horton defends a *separation* of organisation and education and consequently, experts and learning in a context where the expert doesn't know where the line is. Horton makes clear this separation because he considers most people (especially experts) don't. This is not to say that an organising experience can't be educational but 'it has to be done with the purpose of having democratic decision making, having people participate in the action and not having just one authoritative leader'. (Horton & Friere 1990: 124) Education and organising are different – and experts should never become educators.

---

1 The work of Michael Shanks has very much informed my research into learning through archaeology http://traumwerk.stanford.edu/~mshanks/traumwerk/index.php/The%20life%20of%20an%20artifact

Friere takes Horton on by pointing towards the need for strategy (or mobilising as organising):

> You have to have some tactics that have to do with the strategy you have. You understand the strategy as the objective, as the goal, as the dream you have, and as the tactics you raise as you try to put into practice, to materialize the objective, the dream… A good process of mobilizing and organizing results in learning from the very process and goes beyond. (ibid: 117)

If learning processes are dialectical they can be organisational (strategic) and educational (tactical) at the same time (Friere argues that this is so.) Where the expert leads the experience, participants aren't questioned and the process is therefore essentially non-reflexive, this cannot be described as education for change – as people don't participate in or own the process. Friere argues that organisation has a strategic role to play but it is not systematic.

What is important to draw out here is an assumption that strategy is concerned with organisation of education and is expert-led. Both Horton and Friere differently highlight how crucial it is to unpick this assumption and to redefine what 'organisation' might mean in terms of progressive notions of learning. This leads me on to consider how an understanding of *disorganised* learning might be framed in the conversation between Horton and Friere.

Disorganisation

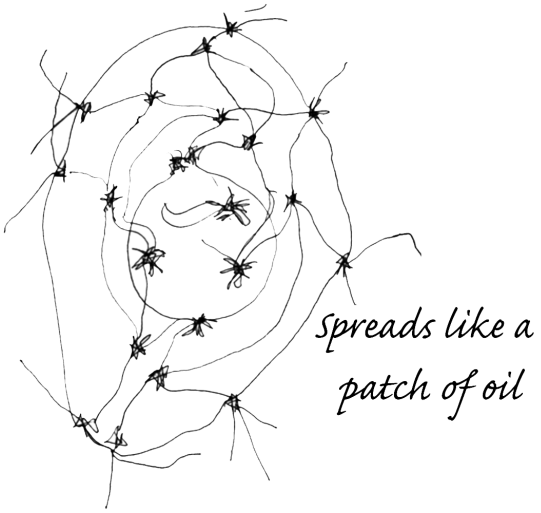
Scott Lash (2002) argues that in the information society, ideas circulate external to the subject and this space of flow can create a space for critique. An element of his argument is that organisations are in decline and disorganisations are emerging through this decline as side effects of the process. He says that disorganisations are not therefore the absence of organisation, but a by-product of its decline. As such, they are value co-ordinated rather than norm-led, always on the move, open to interference and invasion and participants in disorganisations are involved in activities. In a nutshell, they are anything but systematic.

> Much of the work that goes on in disorganisations is not just utilitarian management, but involves creativity. This sort of innovation is not typically a question of aesthetic genius, but instead of cutting and pasting, it is a bricolage, or *basteln*. (Lash 2002: 43)

Lash makes a clear distinction between informal organisations and disorganisations; disorganisations are not simply lacking organisation. Key characteristics of disorganisations described by Lash focus on temporality, mobility, activity, anti-system, valued-led, unruliness and as such have resonance with Deleuze's rhizomes (Deleuze, 1987) in that they are producers of values:

> They form, they de-form, they break up and come together again in different places. Their existence is one of being on the move. They cross borders, and like rhizomes put down rootless roots. (Lash 2002: 41)

Fig 2



Lash argues that circulation of the idea (the 'operative unit' of an information society) through networks of humans and intelligent machines is moved/motioned/flowed by reflexivity through the idea – thus the idea can operate external to the subject and is reliant on a community. Communities concerned with learning, however, are usually described as physical sites rather than processes. Yet, those concerned with researching space and learning may argue that this concept is in decline.

> People interact with each other and objects in space and in so doing construct, disrupt, and resist meanings and understandings. They therefore invest certain meanings in their built environment through the forms of interaction in which they engage… The attempts to spatially order the curriculum is therefore always subject to disruption, because one cannot escape the wider networks within which it is enmeshed. (Edwards and Usher, 2003: 5)

Experience developing chronologically in a linear way as time advances is a notion that informs much pedagogy and practice in education today. Such linearity is at odds with a spatial experience of the world that is produced through connections and intersections or networks within networks – characterised by tangle or confusion. Edwards and Usher argue that there is a need for education to develop 'cartographical imaginations' that are about

geography, inter-connections and history and can be described as plural, relational, space-time:

> It is through cartographical imaginations – investigating the spatial orderings of learning – which we begin to embrace different understandings of the practices in which we are involved and the ways in which generative spaces for learning and knowledge production are actively constructed. (Edwards and Usher, 2003: 4)

If the traditional institution of the school is in decline, we might speculate that organised education is in decline (or a particular kind of organisation). What are the by-products of this decline? And how much do information technologies simultaneously contribute to this decline and are contingent upon it? We might understand learning spaces as networked, complex, interconnected, dynamic, peopled – collectively disorganised.

A nested curriculum

Davis and Sumara describe fractal geometry as 'a recursive elaboration, a thread amid a tangle of strands, not a correction or the root of a new world view'. These authors suggest that fractals in geometry are not anti Enclidean but dependent and distinct from rational, logical geometry:

> Fractals are better described in terms of nodes that are clustered into nodes (and so on)… [reflecting] the multiple, dispersed sites of teaching-and-learning that are present in the classroom collective… Framed in fractal terms, the teacher is clearly a co-participant in the collective mind, one that is implicated in every aspect of learners' knowing… When framed in terms of a co-emergent, nested phenomenon, that is, effectively, a collective cogitation, curriculum becomes something more than a walk along an established path. Curriculum itself becomes a dynamic, living form. (Davis, B. and Sumara, D, 2003: 89/90)

In re-describing the curriculum as a nested phenomenon Davis and Sumara offer an active metaphor that disrupts prescriptive delivery models and creates a framework for proposing an alternative curriculum focusing on mobility and spatiality in learning. Learning *through* location brings the changing materiality of buildings over time and the graininess of human inhabitation into focus as the physicality of the environment we move through is processed into the content of the event.

'Inconspicuous phemonema'

> As women and men simultaneously reflecting on themselves and on the world, increase the scope of their perception, they begin to direct their observations towards previously inconspicuous phenomena… That which existed objectively but had not been perceived in its deeper implications (if indeed it was perceived at all) begins to "stand out", assuming the character of a problem and therefore of challenge. This men and women begin to single out elements from the "background awareness" and to reflect on them. These elements are now objects of their consideration, and as such, objects of their action and cognition. (Friere 1970: 63/64)
>
> stand out – single out – reflect upon – consider – action and cognition

Friere's pegagogy positions dialogue as essential to the act of cognition that 'unveils reality' (Friere 1970: 64) and this is placed against a 'filling up' teaching methodology. In this, his model successfully shows that reflection and action are not split, but two sides of the same coin in problem-posing education. He advocates total immersion as a way of people reflecting on themselves and on the world to increase the scope of their perception. 'Noticing' is therefore a learning process that develops through dialogue with others in the world. So although Friere appears to offer us a somewhat simplistic, linear model for building a learning pedagogy, dialogue between subjects, objects and places (interactivity) is not that simple. Noticing, reflecting, considering and acting are processes that, when combined, may produce a learning event. This combining is contingent on relations between subjects, objects and places that are spatially and temporally specific.

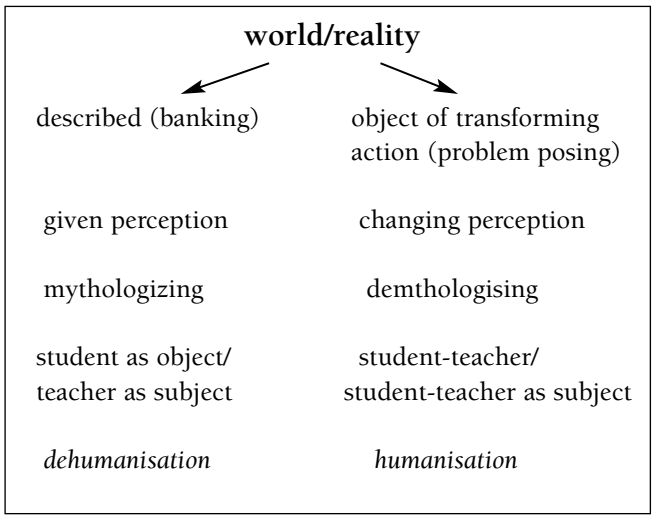
For Friere, a historical being is one that engages with others in a *movement* of enquiry. This movement is initiated by understanding that the 'here and now' in which one is submerged becomes a 'here and now' in which one emerges from and intervenes in – this is a process of becoming and learning is therefore a lifelong activity and described by Friere as 'humanisation'. People's historicity should be the starting point for problem-posing education.

Ivan Illich (1971) makes a clear link between the structure of daily life, learning tools and attitudes toward growing up in defining a need for a different kind of educational experience that is embedded in the relationship between people and their environment. For Illich, education should be disestablished - something that I shall call learning 'out of the classroom' - thus making a direct connection between everyday life and opportunities for learning that are not bound by a singular concept of Institution. Illich makes a distinction between schooling and education and proposes four new kinds of 'formal educational institutions' that he suggests will develop self-motivated learning: things, models, peers and elders.

His concept of an opportunity web (rather than network) describes access to each of these four sets of resources, and this web requires new networks 'readily available to the public and designed to spread equal opportunity for learning and teaching'. (Illich 1971: 78) It is important to note here that Illich sees both the potential and the inequalities of technology – interestingly not just through who has and who hasn't but whether the kind of technology facilitates independent learning, rooted in local community rather than national broadcast. Here he positions the tape recorder as a potentially powerful and autonomous learning tool and the TV as a device to 'sprinkle the continent [Latin America] with institutionally produced programmes'. (Illich 1971: 80) The emphasis Illich places on the notion of a tool that has the capacity to enable learner-produced webs rather than a tool that teaches is crucial to building a pedagogy that aims to take learning 'out of the classroom'. Illich suggests that learning webs rely on a strategic organisation of resources to support unintended or incidentally disorganised activity. And echoes the point Lash was making that disorganisation is active and value-motivated as a side effect of organisation (rather than a lack of organisation). Illich argues that self-motivated learning provides the learner with new links to the world and that while these communication webs can be organised to function, we cannot plan or produce the outcomes.

'Domestication of reality'

Friere differentiates between processes of humanisation and dehumanisation in education through describing the dialectal tension between a banking system of education (the glass is half empty) and problem-posing education (the glass is half full).



Rather than maintainin *credulity* as a basis for education, learning should be a process of enquiry, developing critical consciousness from intervention in and transformation of realities – realities that are necessarily partial, incomplete. Domestication of reality then produces people who are a 'better fit' in society in that they have been adapted to receive rather than question. (In a footnote Friere is horrified by reading lists that define the page numbers to be read. Friere 1970: 57)

> Authentic thinking, thinking that is concerned about *reality*, does not take place in ivory tower isolation, but only in communication. If it is true that thought has meaning only when generated by action upon the world, the subordination of students to teachers becomes impossible. (Friere 1970: 58)

In problem-posing education the object is not the student but the medium that evokes critical reflection and is not therefore the property of the teacher. The prefix 'co' suggests a different kind of learning that is a process fuelled by critical co-investigation and creates some interesting hybrids – learner-teacher, teacher-learner – where roles are continually negotiated through the content of the dialogue between participants in what might be called a learning event.

Friere's concern that the world or reality is at the core of any transformative learning experience, prompts me to consider the walls that are physically present around most formalised learning spaces, seemingly keeping reality from coming in or going out. Jan Nespor provides a thought-provoking insight into socio-spatial processes that affect children growing up outside of the school. Nespor uses de Certeau's contrast between viewing the city from the top of a skyscraper and experiencing it on the ground and Bourdieu's 'detached observers' to present his focus on the importance of considering children's bodies in 'mediating relations with the world'. (Nespor 1997: 121/22) He suggests that as children grow up and are 'schooled' they are spatially redefined.

> Their experiences begin to take place in the abstract spaces defined by written texts and media representations. And school plays a fundamental role in this transformation. It defines regions of space and permissible forms of behavior within these spaces. It tries to suppress bodily movement and expression and to define appropriate bodily orientations. (Nespor 1997: 122)

Nespor asked children to draw and talk about maps of their neighbourhoods and found that they tended to respond by talking about their spatial histories (rather than spatial environment). From these interviews three patterns of histories emerged:

> Embeddedness – kids who lived in the area for a long time with well-defined routes and routines of

> interaction that involved movement outside through networks of friends.
>
> Displacement – these kids were relatively new to the area and had a strong identification with where they had lived before. They tended to spend most time indoors.
>
> Mobility – and these kids were similar to the displaced ones in that they were new to the area but they had moved many times before and weren't attached to any one place in particular. (Nespor, 1997: xvii)

What is important to draw on here is that Nespor uses information on children's journeys to and from school to reveal how physical space and personal histories are connected to create different kinds of movements and interactions. This obviously has implications for how children feel about a place, how they find their way around and how they orientate themselves. Nespor's point is that if we focus education simply on *schooling* then we are in danger of 'domesticating' those realities by negating these socio-spatial processes. (Friere rather dramatically describes this institutional contempt for the world and subsequent flight into seclusion behind the walls as 'historical schizophrenia' and this leads to a 'normalised "today"' in which history is stratified and sequenced into neatly-wrapped, uncomplicated packages. (Friere 1970: 73)) Nespor doesn't focus on the potential of new technologies and communication but on valuing the permeability and fluidity of spatial interactions and physical mobility together with personal histories to better understand learning through engagement with everyday life. If learners are encouraged to reflect on their own lived experience (rather than through a textbook) does this mean that they have greater control over what they do or don't say?

Places for learning

Research into spatial learning and an emerging pedagogy in mobile learning is starting to address the falsity of zoned areas for types of learning highlighted by Illich in the 1970s; stimulating curiosity by enabling learners to follow personal trajectories – being critical through enquiry. Relations between subjects, objects and places could be described as tactical in nature if that they are unplanned, irrational and unanticipated in the learning event – they are both multiple and simultaneous. And the 'curriculum' emerges in a reciprocal process of interaction. We might then describe places for learning as sites that engage in multiple relations of presence, new identities and hyperconnections that are equivocal, ambiguous and discursive.

> When everyday life is understood in terms of spatialisation, temporalisation and embodiment, ubiquitous computing offers a unique opportunity to evaluate the 'relational' as flows, intensities and transductions that mobilise sociotechnical assemblages. (Galloway, 2003: 30)

Such 'assemblages' might be described as nodes, blots, constellations or hotspots in that these terms offer metaphors for describing new kinds of relations between subjects, objects and places afforded by mobile technologies. A to-and-fro discourse is what forms such assemblages – a cumulative tracing of back and forth movement between shifting bodies and positions. Collective reflection on these new kinds of meeting place offers possibilities for invention and intervention.

> 'Here' is where spatial narratives meet up or form new configurations, conjunctures of trajectories which have their own temporalities (so 'now' is as problematical as 'here'.) But where the successions of meetings, the accumulation of weavings and encounters build up a history. 'Here' is an intertwining of histories in which the spatiality of those histories (their then as well as their here) is inescapably entangled. (Massey, 2006: 139)

The notion of sites for learning in networked spaces does not necessarily mean seamless or invisible connections between people, objects and places. I am arguing in fact for the antithesis of the 'any time, any place, any where' principle for future learning scenarios where the place, time and location of interactivity is actually what fuels the learning event. Consider for a moment objects that facilitate social-cultural interactions precisely because they are in physically networked in locations; objects that are searchable and transformable in context. They cannot be activated from the armchair and may, for example, involve movement from one to another across a physical space in order to make connections. Bruce Sterling describes such objects as 'spimes'.

> The next stage is an object that does not exist yet. It needs a noun, so that we can think about it. We can call it a Spime, which is a neologism for an imaginary object that is still speculative. A Spime also has a certain kind of person who makes it and uses it, and that kind of person is called a 'Wrangler'. At the moment, you are end-using Gizmos. My thesis here, my prophesy to you, is that, pretty soon, you will be wrangling Spimes.[2]

2 Quoted by Mike Waller in the briefing paper for 'Intelligent Posters' workshop with the In between Design Research group at Goldsmiths College, London, August 2005. For the full speech by Sterling go to http://boingboing.net/images/blobjects.htm

Sterling's spimes mean that it is the learner who is mobile, not the gizmo or gadget and it is space, time and embodiment that augments our experiences of the city rather than handed-down content. This concept allows us to think about objects that are searchable, transformable, located and potentially can change in response to user or context or time. The granularity of the everyday is not made invisible by seamless technologies but in fact is made visible through located spimes. Can learners make new relations with their environment through using such objects?

Spatial contiguity

Earlier in this paper, I considered the importance of *noticing* through a reading of Friere's term 'inconspicuous phenomena'. It now seems relevant to conclude this part of the paper by positioning spatial contiguity as a key element in an alternative pedagogy focusing on mobility and spatiality in learning. Locative media offers opportunities for learners to learn through making associative connections, by being in social *proximity* with objects and places so that we can start to define what might be meant by heightened spatial awareness. I would like to introduce the concept of *e*touring, a set of processes that have been built and developed to explore how currently available mobile technologies can be used as a toolkit for people to prospect a site through e-motioning between places and objects as critical-spatial learners.

FIG 3

User constructed tracks

spatial (re)collection/memory paths: collecting, putting together, to generate movement

2. Part Two: Disturbed findings

Personal appropriation and public transference of meaning offers creative walking practices the scope to disrupt delivery modes of organised tours. The speed at which walking happens, accelerations and decelerations, different perspectives (top-down viewpoints and immersive jostling) affect the way in which people move through, what they notice and where they go next. The experiential physicality of motion, momentum and position throws up productive opportunities for making place, and place making people. (The video-bus tour, a type of city coach tour where the visitor doesn't have to get off the bus, represents the very antithesis of this.) This part of the paper positions mobility, actual bodily movement, as the transformative element in developing spatial awareness as critical practice in learning through the design of walking projects in urban environments.

Critical spatial practice

Criticism as design's accomplice is a consumer's product; the review or guide that advises on best buys and is therefore neutral and objective. Processes of construction are hidden as the consumer is diverted into what 'they need to know'. Rather than describing, critical practice seeks to transform:

> The relationship critical theory has to practice is not one of exemplification nor of application, but rather of ongoing critical transformative dialogue… If practice is seen as the making of perfect objects, it is also about 'practicing' - trying to get it right but often getting it wrong. Practice intends to answer a set of aims. Critical thinking questions the values of the aims themselves. Thinking is also a practice. It is something we do. We make ideas. (Rendell, 2002: 47)

Tour design as an interdisciplinary process and practice that is both critical and spatial offers us a way of thinking about production and reproduction of the tour as a constructed event – both spatially and socially. Exploring thresholds between private and public in tours can engage in a critical practice that is spatially and socially produced. The tour as a vehicle for encounters between people, objects and places offers possibilities for critical and spatial practice in learning through the built environment. Can these encounters produce places? Rendell suggests that subject encounters with art are relational. She highlights that critical tools can be discovered through processes of criticism. Strategic critique, work that exceeds itself and abuts on experience, uses such moments to locate the work. Rendell describes these procedures of discrimination as intrinsically spatial.

In a talk on 'Writing Spaces', Rendell argues that it is a *combination* of voices – formal and informal, from dictionary definitions to personal stories - that challenges criticism based on objective knowledge with a singular point of view. Instead subjective, multiple and engaged dialogues are produced through criticism as a spatial or situated form of *practice*. This form of writing operates between the critical and creative - between writing about and writing as a practice in its own right.[3] Reframing the tour as critical spatial practice furthers this discussion on voice; how multiplicities of different kinds of voices in the tour create dialogues that are transformative in producing place.

Relations between motion and emotion very much informs my practice in designing 'out of classroom' learning projects that develop Jane Rendell's concept of critical spatial practice[4] within a wider context of mobile learning and artists' walks. These projects aim to challenge the delivery model tour that that characterises many off-site educational activities, and instead invites participants to produce the event themselves as they engage in moving through a site. The content of the project is determined by an understanding of site that is concerned with exposing the processes and practices of everyday life and as such is concerned to discover multiplicities of narratives that make a place and, in combining these, reproduce that place in new and different ways.

> Where ubiquitous technologies might fail is if they prevent or inhibit the ability of a person to experience the city on his own terms; if they start from a premise of what the city is rather than allowing it to emerge through the movements of its people. (Galloway, 2003: 28)

Site is understood as fluid in some way. This may be through exposure to site histories or hidden geographies or through the personal experiences of inhabitants. For some this site may be an abandoned building or industrial ruin (Tim Edensor, 2005) or analysis of found objects in the tidal foreshore (Mark Dion, 1999). But the site could also be the in-between spaces in a building – the aspects not formally presented to the public. They may also be temporary sites, sites of personal memory or commemoration. Space defies coding or fixed definition if understood through the movement and experiences of people moving through it. And buildings are found rather than designed.

2.1 Etouring

Do we want a gadget that can see through buildings or do we want learners who can find cracks in the concrete? There are two ways in which we might look at disruption when developing pedagogy for learning out of the classroom with a mobile toolkit. One way might be to consider practices that deliberately disrupt the perceived order of things in the built environment by taking 'illegal' action – for example, jamming advertising boards or countering a proposed masterplan. These activities can use mobile technologies to *infiltrate*. On the other hand, we can think about disruption as activity that embodies participatory learning through challenging delivery models of teaching. These kinds of activities can use mobile technologies to produce the learning event through *affiliation*. A toolkit that enables (re)production of the built environment doesn't start with research into high-end kit, but with knowledge about how learners can intervene in such environments, combining technologies with the physicality of their own bodies to make new discoveries. It is the ability to make sense of the unpredictable or to discover anomalies in the urban built environment through an affiliated community of learners that enables local invention and creative researching.

Located learning activities designed through a series of learning-through-touring projects have contributed to a set of key processes concerned with designing off-site mobile learning experiences. These processes intentionally prompt new kinds of practice in designing user-constructed spatial narratives as learning projects – projects I shall call *e*tours. This term has evolved from the work of Guiliana Bruno who weaves an interdisciplinary mapping of film, architecture and the body through her *Atlas of Emotion*. She argues that the restlessness of mobility engineers a dynamics in the relation of motion to emotion through the moving image. This is a matter of voyage, a moving out, a migration, a transference from place to place (Bruno, 2001: 262) and the subject experiences a dislocation that affects a 'pull of emotion'. Spatial transfer as a 'moving between' opens up possibilities for describing the stitching together of fragments whilst moving as *threading*. Bringing studies in mobility to learning pedagogy creates an intersection for researching threading as a mobile learning process with an understanding that place is not universally defined, but is produced through e-motional interactions between subject and place. Moving described as threading is *learning* activity in that it is developing an ability to connect subjective movements between objects and places in making new understandings – and making this critical by describing and reflecting upon the thread produced.

3 www.tate.org.uk/onlineevents/archive/MakingPublicSeminar2

4 Critical spatial practice is fully developed in Rendell, J., 2006, Art *and Architecture: A Place Between*, I.B. Tauris, London/New York

Bruno draws on researchers in contemporary neuroscience to suggest that science is making connections between motor activity and perception of the physical world; she quotes Israel Rosenfield[5] to present how neuronal groups in the brain, organised as maps, communicate with each other through to-ing and fro-ing to create 'notions of things and events'. (Bruno, 2001: 263) If perception and understanding are closely related to haptic bodily movement through the physical environment this is very relevant to furthering our understanding of attributes of the mobile learner.

> At historic tourist sites, memory is increasingly organised according to 'heritage' which 'fixes' history and potentially limits the interpretative and performative scope of tourists. (Edensor, 2005: 133)

This is the crux for those concerned with understanding contingency in relations between learning and mobility. Traditional guided tours are generally designed for the passive recipient; touring as learning means that physical materiality and sensory bodily movement can be brought together into a tripartite relationship with mobile technologies. If site can be expressed creatively this may be understood as a liberating process yet this may become disruptive if learners are actively pursuing different or seemingly conflicting histories of a place, unfixing organised notions of heritage and urban planning, notions that take little account of what people bring to that place.[6] Noticing and recording anomalies gives learners opportunities to become critical-creative researchers, using the form of the guided tour as a platform for inviting others to participate and do the same. The *e*tour effectively becomes an outcome of a collectively-produced, critical-spatial learning event.

Etouring processes

Key processes of the *e*tour are presented here as cards. Each card sketches a theoretical positioning for the process, an example of use in a focused activity and its potential wider learning application. The form of the card means that these processes can be shuffled, selected, paired to bring about new combinations and connections when designing *e*tours.

*E*touring processes are contingent on what *propels* participants to move around a building or through buildings. What motivates the next move is explored through these processes that set up particular kinds of learning activity dependent on interpretation of location. These processes act like filters on a site – they provide

FIG 4 HAPTIC REFERENCING

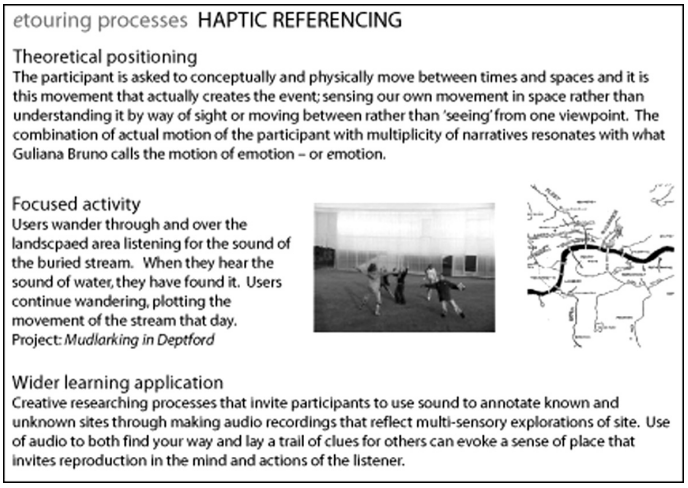


FIG 5 GROUND UNTRUTHING

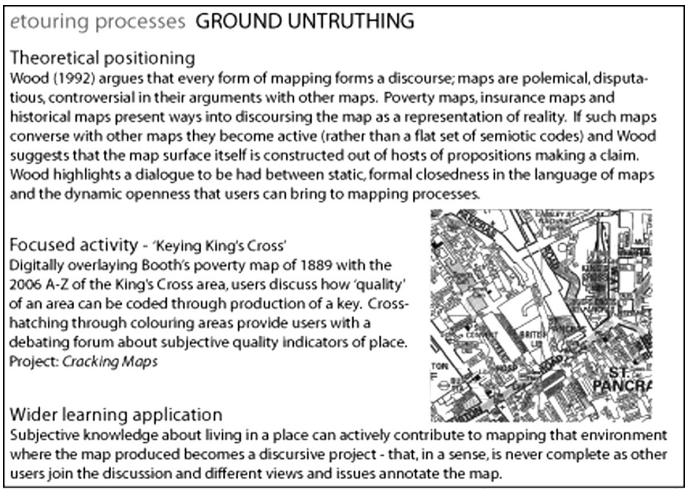
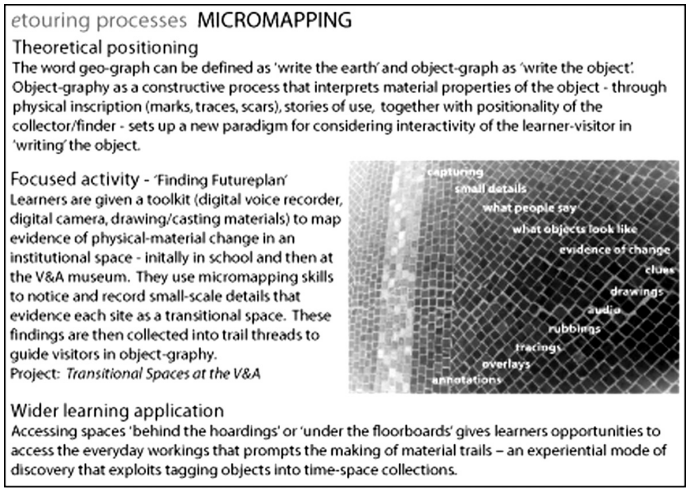


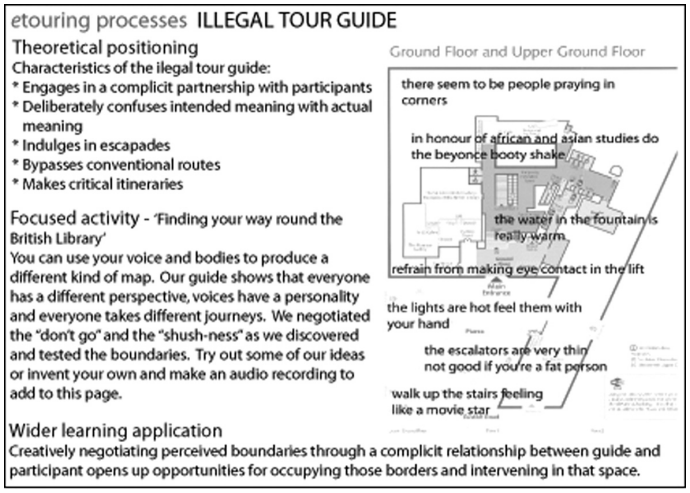
FIG 6 MICROMAPPING



5 Rosenfield The invention of Memory 79-80 in bruno p263

6 For example, masterplans are posted for 'public consultation' but are often opaque in both communicating to and consulting with local people

FIG 7 ILLEGAL TOUR GUIDE



opportunities for participants to produce the tour themselves by using *e*touring processes to focus, or even justify, their movement from and to. As facilitator of the event, my job is to design processes and activities that prompt participants to move around a site that develops a discipline of noticing through 'stumbling upon' and 'making connections'. Built spaces provoke different kinds of processes, for example, the 'illegal tour guide' is a process that thrives on ordered, planned space that explicitly evidences authority in determining its use. 'Micromapping' asks a participant to explore a place through making connections between small scale details or 'finds' and wider social, material or environmental issues using recording devices and methods that can open up creative interpretation.

An *e*touring process I would like to introduce as a preface for the last section of this paper is 'way ma(r)king'. This process positions the tour guide as a navigational tool both marking and making paths through the city. Learners use the guide to engage with activities associated with excavation: interrogating, digging, plotting and tagging through walking and mapping an urban site. In this way, physically exploring an urban site can engage learners in moving towards higher order thinking skills, from material description of finds to making associative meanings through posing different types of question:

1 What do you know about this find? Describe its material properties (describing)
2 What else do you know about it? (explaining)
3 What else could there be to know about it? (projecting, contextualising, analysing)
4 How could you get to know everything about this object? (imagining, associating)

Such a process of enquiry is mobile if the location is the source material – and testing a site for richness (prospecting) becomes an integrated element in the learning experience. In the following project idea, I present an idea for designing an urban excavation toolkit that engages participants in moving through such a process of enquiry through:

1 walking and recording finds
2 producing maps of trails and finds
3 identifying patterns and layers of located finds
4 inviting others to make conjectures

Rendell (2002) suggests that in language use, prepositions 'possess a strong suggestive role. They are capable of changing 'everything around them' and provide a means of making connections between two, between people and between people and places.' (Rendell 2002: 52) When brought to reading the everyday prepositions can be seen to connect positions, relationships and time in making and remaking place identities. What if objects take on prepositional characteristics – to create different kinds of collections? As the object is tagged, it becomes active in its relations with other objects tagged by other people on the move thus creating the potential for object-stories. Movements may fall into types of motion such as: clustering, repelling, isolating, cluttering, spreading, hosting, massing. All kinds of movement, prompted by e-motional connections between the finds, starts to unpick the notion of slippage from the well-defined path – drifting off, slipping out of view, hanging back. Is it possible to produce a self-initiated learning path? A path as a combination of real and imagined possibilities, smudging boundaries between real and fictional, organising and mapping knowledge through found objects along the way. How do learners make such paths?

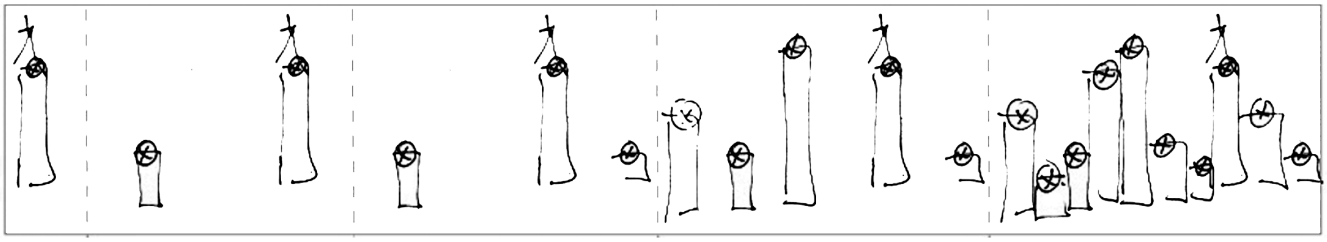
2.2 *Excavating Concrete: digging and prospecting the built environment*

> 'Object hunting'
> In the beginning, it did not go well. The city was new for me back then, and I always seemed to be lost. I squandered time on forays that yielded nothing, bad hunches on barren streets, being in the wrong spot at the wrong time… I had no method as the others seemed to have, no way of knowing in advance where to go, no sense of what would be where and when. (Auster 1987: 34)

The idea for this project came about when I was given an opportunity to see Wenceslaus Hollar's 'Long View' being prepared for an exhibition at the British Library[7]. The

7 *London: A Life in Maps* Exhibition Nov 06 - Mar 07 at the British Library, London

FIG 8



Conservation Department were busy piecing together and mounting some of the maps for the exhibition and while I was watching this, I listened to one of the team talking about Hollar's 'Long View of London' panorama. He said that Hollar used the Spire of St Saviour's Church (now Southwark Cathedral) as a position for drawing. I wondered whether he had just used this vantage point or several others dotted along the Thames vista and this led me on to thinking what kind of long view might be drawn today and from where.

Can the viewer from the top of the building see the details of a prospect they are looking towards? How does the prospector communicate with the digger? Can an archaeological site be repositioned to the concrete, everyday surfaces of a city so that changes can be tagged to form an evolving prospect of that site?

It may have been that Hollar's sight differed so much in his two eyes that he did not have binocular vision, and effectively used only one eye or the other at any given moment. What is self-evident is that, by one shift or another, he did achieve amazing clarity both for distant scenes and for minute things close at hand…
(Tindall 2003: 93)

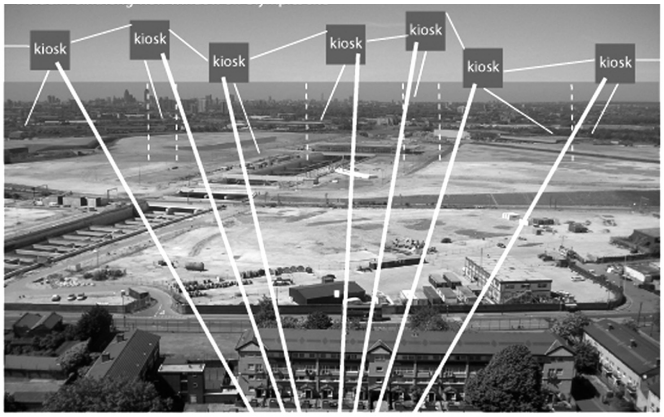
Level One: Digging
Can we see in this way? What kind of archaeological activity might be affected by shifting focus between long view and near view? If we translate Hollar's shifting vision between near and far into physical movement, the production of a long view through walking between a sections of high-up views potentially propels participants up and down an urban typography, gathering and recording the details as finds along the way. The movement and recordings are GPS tracked and so can be uploaded and published at various project kiosks dotted around the site. What kind of questioning about a place does this shifting prompt – and therefore what kinds of urban archaeological trails are initiated? The recordings can be published on both grid and topographical routes on an interactive map at a project kiosk, so they and others can see routes travelled, at what height and when they have made a recording. They can also interrogate the recordings to find out what has been collected whilst out in the field.

Each project kiosk has a geographical zone and will only accept data from within that zone. Zones can vary in size; the closer the kiosks are to each other the smaller the zone. Zones can also be set according to a social, cultural or environmental theme or issue for exploration so, again, it is the location of the kiosk that is important. This means that a participant's data is downloaded to different kiosks depending where they are when making the recording and the proximity of the kiosks. The project kiosks publish the collective recordings made by diggers in their zone on to a plan map of the area and other participants in the project can interrogate the map by selecting an area, downloading the content on to a mobile device and listening/viewing the recordings made by several individuals in that zone. The content is also sent to a central server connected to a public viewing window of the entire site. It is here where the long view of the site is collaboratively built by placing the recordings (represented by dots) on to an interactive long view window.

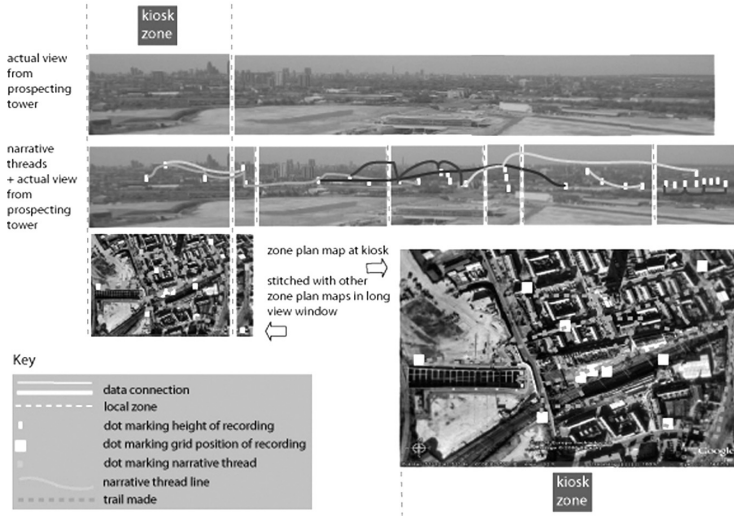
Level 2: Prospecting
The interactive long view window frames a real view of the site and is the prospecting base for the project. It's 'glass pane' is interactive so that the participant can see the actual distant view through the pane whilst simultaneously watching data being plotted on the surface of the pane – thus requiring them to shift their viewing distance between near and far. The pane, in effect, becomes the surface for mapping a long view of the area. Participants can move between far and near by clicking on the data dots to view or listen to the recorded content. They can also switch to view the dots positioned by height as well as grid location. Participants are invited to respond to the diggers' dots by joining them to dots to create trails, linked as narrative threads across the zones, and send these back to the located project kiosks in the field. All dot data can be downloaded from the long view to mobile devices for take-away reflection or to start a new project.

The following visualisation shows how the concept could work in the London Borough of Newham where the rate of change in the urban elevation is speeded up by the London 2012 development and so offers an interesting location for such a project.

FIG 9



Excavating Concrete
Stratford, London



It is the shifting between near and far that creates the critical space in this project. The local project kiosks are positioned in everyday spaces and connected with the strategic plan view of the site. Each informs and evolves the other. So at a school project kiosk, for example, they can download narrative threads made using some of their own inputted data combined with that of others from different zones. They can learn about what is important to other people in other zones, track changes, communicate with other participants and continue to make and upload their own local recordings. Perhaps most importantly, the project provides a way for local residents, visitors, developers and local authorities to gain an understanding of transition in a large scale site by plugging into stories and issues at everyday, ground level.

Concluding thoughts

> What another person has seen fit to throw away, you must examine, dissect, and bring back to life… Everything falls apart, but not every part of every thing, at least not at the same time. The job is to zero in on these little islands of intactness, to imagine them joined to other such islands, and those islands to still others, and thus create new archipelagoes of matter. (Auster 1987: 36)

In this project, prospecting is a process of **critical-creative enquiry** that penetrates the seeming solidity of the concrete built environment. The process works in three ways:

1 Negotiating access to the top of buildings and setting up guidelines for producing topological maps of an area through climbing upwards and recording position and selected view to scope a terrain.

2 Populating prospects through collecting and recording objects and people as 'finds'. Relations between objects are drawn through participants making and publishing object-trails for others to follow and evolve, connecting subjective knowledge with materiality of the built environment.

3 Merging topographical with grid data to produce an interactive, collectively produced and located urban long view based on proximity, position and movement of participants. Learners are described as interrogators, diggers, plotters or taggers depending on the nature of the activity they are involved in.

In this way, locative media prospecting uses topological mapping as a measure of social proximity, invites learners to find and challenge what constitutes urban public space and potentially provides a platform for collective curiosity in finding, locating and debating transition in urban environments.

> In relation to the creative collaborations it narrates and places together, it does not come to the point. It provides instead a platform on which their connections can be grasped. Now it is time to catch flies. (Carter 2004: 194)

Paul Carter uses the spider's 2nd phase construction of its web as an analogy to describe his book's structure and I like to think that his concluding thoughts somewhat reflect the structure of this paper but, perhaps more importantly, embodies the nature of mobile learning.

Acknowledgement

Peter Rogers, digital artist, has collaborated on all of the projects that have contributed to this paper

References

Auster, P., (1987). *In the Country of Last Things*, Viking, NY/London

Bruno, G., (2002). *Atlas of Emotion*, Verso, London/NY

Carter, M., (2004). *Material Thinking*, Melbourne University Press, Victoria

Davis, B. and Sumara, D. (2003). 'The Hidden Geometry of Curriculum' in Edwards, D. and Usher, R., (eds), *Space, Curriculum and Learning*, Information Age Publishing, Connecticut

Deleuze,G., (1987). 'Rhizome versus Trees' in *A Thousand Plateaus: Capitalism and Schizophrenia*, University of Minnesota Press

Dion, M, 1999, *Archaeology*, Black Dog Publishing

Edensor, T., (2005). *Industrial Ruins: Space, Aesthetics and Materiality*, Berg, Oxford/NY

Edwards, D. and Usher, R., (2003). 'Putting space back on the map of learning' in Edwards, D. and Usher, R., (eds), *Space, Curriculum and Learning*, Information Age Publishing, Connecticut

Friere, P., (1970). *Pedagogy of the Oppressed*, Continuum Publishing Company. This edition published 1996 by Penguin, London

Galloway, A., (2003). Resonances and Everyday Life: Ubiquitous Computing and the City. Draft. Available online at : http://www.purselipsquarejaw.org/mobile/cult_studies_draft.pdf

Horton, M and Friere, P, (1990). Edited by Brenda Bell, John Gaventa and John Peters, *We Make the Road by Walking*, Temple University Press, Philadelphia

Illich, I., (1971). *Deschooling Society*, Penguin, London

Lash, S., (2002). *Critique of Information*, Sage, London

Massey, D., (2005). *For Space*, Sage, London/California/New Delhi

Nespor, J., (1997). *Tangled Up in School: Politics, Space, Bodies, and Signs in the Educational Process*, Lawrence Erlbaum Associates, New Jersey

Rendell, J., (2002). 'Travelling the Distance: Encountering the Other' in Blamey, D. (ed), *Here, There, Elsewhere*, Open Editions, London

Sprake, J., (2005). *Mudlarking: A Manual* (unpublished)

Tindall, G., (2003). *The Man Who Drew London*, Pimlico, London

SUSTAINING LEARNING ACTIVITY FLOW IN A FRAMEWORK FOR UBIQUITOUS LEARNING

M. Felisa Verdejo, Carlos Celorrio, Emilio J. Lorenzo, Alberto Ruiz, Teresa Sastre
LTCS Group, UNED
C/Juan del Rosal, 16, 28040, Madrid, Spain
{felisa,emilio, aruiz, tsastre }@lsi.uned.es, ccelorrio@bec.uned.es

Abstract
This paper describes a pedagogical and technical approach for sustaining a flow of collaborative learning activities outside of school and in class involving tasks of preparation, data gathering, data analyzing, visualization and modeling related to a diversity of content areas. The background for the mobile technical infrastructure, based on a Learning Object Repository (LOR) that provides interoperability mechanisms for learning tools, is discussed. Finally, sets of scenarios included in a real pilot study where learning activities are carried out are described to illustrate our approach.

Keywords
Ubiquitous infrastructure, Learning Object Repository, learning tools integration.

Introduction
Mobile technologies have demonstrated potential to enrich learning and teaching inside and outside the classroom. An increasingly number of experiences is reported, where handhelds are used for data collection, multimedia information access and communication as well as supporting a variety of classrooms activities, such as student response systems. However all these technologies are often a range of unintegrated options, and typically there is not support for a workflow of activities where data, content and artefacts could be shared and reused along long-term learning processes, either by the authors, teachers or other contributing peers in a learning community. In the ENLACE Project[1] we are exploring the design and implementation of a technological infrastructure, as an educational network platform offering services that will provide ubiquitous web applications for learning activities both inside and outside the classroom in order to improve student learning and teachers' work [Verdejo et al, 2006 A]. A guiding principle in our approach is to inform the technology design with a set of rich scenarios grounded on current learning sciences research on socio-constructivist learning. We are implementing with teachers and experts, scenarios and the technological functionality for supporting them, to foster active and constructive learning process, meaningful related to different subjects, where the study of a problem is considered through different facets and methods.

In our vision students are engaged both in individual and collaborative activities that promote their curiosity by inquiring about open questions, directly exploring and observing their environment, compiling information, analyzing and representing data, building models to explain and predict behaviour, exchanging and discussing their findings, linking their view with real problems faced by professionals and contributing to create a shared memory with personal traces in a learning community. For example, a middle school teacher proposes a question to their students: Why does this bird live in this place/habitat in spring and summer time? This question acts as the thread for a series of activities in differently localized scenarios, including a field trip to a nature park to experience and identify that particular habitat and raises not only topics related to the natural science subjects (flora, fauna, habitat, climate), but to music (motivated by the need to identify the sounds of the birds), to geography (topographic and relief maps), to mathematics (to calculate and represent distances using different measures) motivating also teachers to coordinate themselves and integrate their respective agenda into a larger perspective. The learning workflow includes activities for a long term period (to be carried out either in sequence, parallel, or overlapping in time) in different scenarios (classroom, home, computer lab, field trips…), involving teachers and learners belonging to a school and nature monitors from an association. The educational network should embed the technologies to collect data in a site of interest, supporting its recording and reuse later on, to facilitate the articulation of physical exploration of a site of special interest, with analytical reflection in the school. In order to permit a smooth flow throughout the scenarios of activities, the technological infrastructure should grant a ubiquitous context challenging the integration issue through the school curriculum, location, time, social

1 http://enlace.uned.es

organization levels, across devices, interoperability, and connectivity. An important component in this educational networked infrastructure is the "Learning Object Repository" (LOR). The LOR integrates data and artefacts created from heterogeneous resources. Artefacts, in this sense, are the products produced by the learners using certain tools on a diversity of devices. The LOR provides an adequate framework for storing, retrieving and re-using individual and group results and by-products, offering group and community navigation tools as well as mechanisms to detect similarities of interests in terms of the produced objects or artefacts [Mayorga et al, 2005]. These user-created artefacts are meant to be reused by students in diverse contexts, and using other tools or different devices. For example, using the LOR, users can exchange different annotated and conceptualized pictures to cover views of a tree in different seasons, to complete their measurements, or to aggregate collected data, in order to enrich the joint models of the ecosystems through different observations taken at various sites, in different periods of time, all throughout the year. The technological infrastructure is discussed in section 2, it includes the LOR functionality, and the educational network as deployed for the ENLACE project. Sets of scenarios where learning activities are carried out are described in section 3 to illustrate our approach. These activities are performed in a pilot test running with teachers and schools students along the period 2005/2007.

The Technological Infrastructure

2.1 A Learning Object Repository

Let us consider as a starting point the definition of the NII Learning Object Glossary: a Learning Object Repository is a searchable database that houses digital resources and/or metadata that can be reused to mediate learning. Accordingly to this definition a learning object is any resource that can be used to facilitate learning and teaching that has been described using metadata.

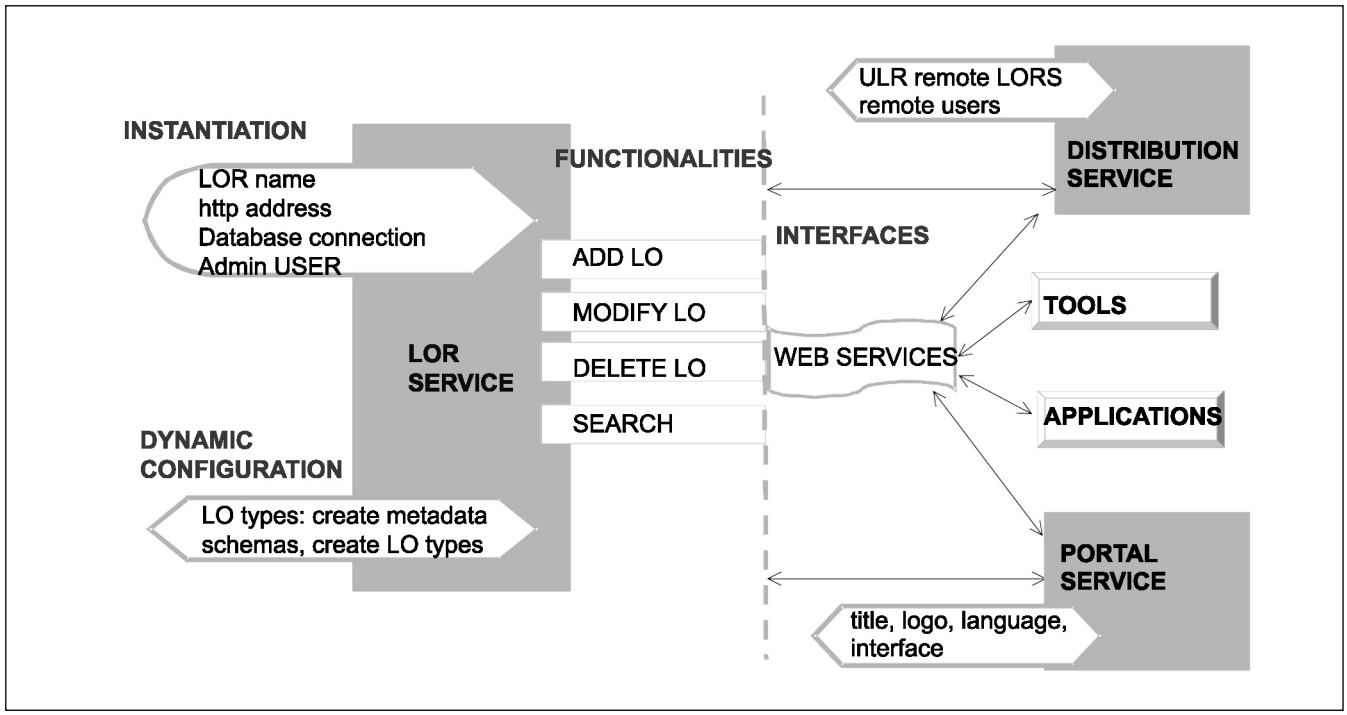
The focus in standardization committees has been on the definition of a learning object (LO) as a small content (multimedia material) to be reusable for preparing course content typically to be delivered through a Learning Management Systems (LMS). A number of LO Repositories following this LO conceptualization and using the metadata standard (LOM) have been reported in the literature. [Neven and Duval, 2002] provide a comprehensive survey on LOM-based repositories.

On the one hand, this underlying idea of a LOR as a means to deliver content does not fit the learner-centered principle sustained in a variety of current learning theories, where the approach is for learners to dynamically create their own learning objects: artefacts to be built and shared with peers in a learning community as well as reflected on individually [Bellamy, 1996]. A basic functionality provided to the users of a LOR is searching, based on metadata fields. In the case of LOM compliant repositories, the metadata captured follow the IEEE LOM standard metadata scheme [IEEE, 2002]. As this metadata scheme is not especially useful for more specialized collections of objects, a number of repositories have develop their own application profile, trying to maintain interoperability with standards. It is important to notice that a unique standard would not fit all needs, and therefore the exchange, filtering and mapping of metadata is a problem to be addressed in the architectural design of a LOR.

Our learning repository service is the result of several years of research undertaken in two European projects for collaborative learning in experimental domains. The need of a persistence mechanism evolved from the Active Document [Verdejo et al, 2002], a system allowing to specify learning designs and automatically generate a collaborative environment where students could carried out the set of experimental activities, either in the lab or by simulation, with a set of tools. The outcomes created by each student/group in their learning activities, were dynamically recorded in a personal notepad, with a XML format to structure and index in context the outcomes with the tasks. The "objects" were stored as learning objects in an internal database. A first requirement for reuse in this framework addressed both a student need and a teacher need. For students, it was important to reuse their partial results in further experimentation and reporting, for the teachers it was a great advantage to reuse theirs learning designs for other related activities instead of starting a new definition from scratch. At the same time, other partners required a more tool centred view, and were interested more on the reuse of the student's outcomes than in the learning design specifications. So, the next step was to redesign the repository to be 1) Directly interoperable with any external tool that could be useful for the learning activities, using or not a learning design specification and 2) To consider the storage of learning designs for teachers to reuse them.

A new repository prototype was implemented with an interface for interoperating directly with different tools. This prototype was embedded in a semantic portal with searching facilities for the users to manage directly Learning Objects [Verdejo et al 2004] in workspaces, views of the repository, reflecting the learning community organization. The third and final prototype consisted on separating the repository from the portal, and defining it as an external service that could be configured, installed and used by any system. This last version included also the possibility of having distributed repositories [Celorrio et al

FIG 1. DESCRIPTION OF THE LOR SERVICE AND OTHER SERVICES AVAILABLE



2006]. The service has been used to generate a number of repositories in current projects, involving researchers and users.

2.1.1 The LOR service

The LOR service (Figure 1) provides functionality directly accessible from a portal interface, and remotely available via web services. The LOR service offers facilities for managing LO, instances of the LO types that have been defined. The operations are: adding, modifying, deleting or searching objects in the repository.

A LOR is configurable with a set of parameters needed to install and configure the service. Then, additional data allows to personalize and adapt it to the environment where is going to be used. The installation data are: the name of the LOR, the address to be installed, database connection parameters. The configuration data includes information about the users, and the definition of the types of LO. For all these data, the service offers default values that can be modified during the configuration or during the usage of the service.

This repository service, in the current state, offers

- A persistence mechanism for community sharing and reuse of learning resources
- Concerns to standards: LOM metadata compatibility and content packaging
- Interoperability via web services with external tools
- A layered expressivity: a version relying on metadata, fully automatically deployed. There is a version relying on ontologies with a wider potential for semantic searches but needing ad-hoc management of the ontological modules and the supporting software.

As well as the following featuring characteristics:

- Heterogeneity, i.e. the possibility of storing objects belonging to a variety of Learning Resources: LO types/metadata schema, tools or learning designs defined by application profiles in a declarative way.
- Mechanisms for handling automatic generation of metadata for objects created with external tools, via application profiles for tools.
- An application- a community portal offering:
  - Flexibility for community personalization (workspaces for individuals/groups/communities)
  - Contextual metadata generation for LO, extracted from activity and social models in the metadata version (these models are ontologies in the richer version)
- A service for synchronizing distributed repositories in a network
- Enhanced searching facilities based on metadata, including query by example, relevance feedback, filters and query patterns.

Searching is an important functionality offered by the LOR service. Different modalities of searching are offered based on the constraints expressed in a combination of metadata fields through templates. This functionality can be used by an external tool for finding the necessary objects the user may request to carry out a learning activity with that tool.

The retrieved objects can be directly downloaded from the repository to the tool, then handling the objects inside the tool, and lastly reincorporated them to the LOR as a new LO version. In this case the function of the repository is not only to be a persistence mechanism for that tool, but a group memory offering the access, share and exchange of artefacts within a learning community.

Searching can be done by query by example (selecting an object, and using its metadata as a starting template), filters (predefined combination of templates that provide useful and recurrent queries) and query patterns (parameterized combination of templates, that the user can modify and instantiated). Filters and query patterns can be created either by a tool or when configuring the portal.

A main reason for searching is reusing. Thus the role of metadata is to facilitate users and software tools, the query and retrieval of objects, potentially useful for a specific purpose in the learning process. A challenge here is to be able to define metadata capturing the potential interest of an object to be reused. Our approach is to differentiate and enrich the metadata information because it is not the same to describe an object, which is a qualitative model, than an object, which is the result of a simulation, or an object representing experimental data, in each case the number and description of interesting features are different. Therefore an open issue is to characterize from a conceptual point of view classes of artefacts or constructs built with a variety of learning software tools, which could be formalized as an ontology.

2.1.2 Metadata Schema, LO type and LO instances

Technically a LO can be seen as a mechanism for packaging a set of files together with its description in order to be able to store and reuse the object in different learning situations. In our approach, a packaging model is used to create an LO that includes the object itself and a set of metadata, both packaged in a zip file. The metadata for a particular object is made of a collection of fields, any of which, in turn is composed of a name and a set of values. This metadata is included in an XML file called manifest.xml.

In our repository, A Metadata Schema is defined as a set of metadata fields that will be used for describing a type of learning resource. Specifying a metadata schema consists of creating a set of metadata fields and saving them all together with a metadata schema name. For each field a name should be provided along with the cardinality and the indication for the range to be unique or multivalued. Values for a metadata field can be configured as free text, as dates, numeric values, values belonging to a vocabulary or terms belonging to an ontology. By default, we provide a General Metadata Schema that includes some of the fields described in the LOM standard.

A LO type in the repository defines a class of LOs, whose description is an aggregation of a General Metadata Schema plus other metadata schemas defined by the user. The type specification includes also the format of content (for example multimedia material, XML files, models following tool specific formats) described with a MIME type. Each type describe a class of LO's. The LO instances are created in a zip file that packages both content and metadata. This zip file is portable to other systems or applications, so the LO instances, are independent of the repository where they have been created. Once a LO type is configured in the LOR, LO instances of that type can be stored, modified, searched and retrieved from the repository. A LO type is the result of defining a group of metadata that collect the key information needed to find relevant objects in a learning context. In this sense, a LO type permits to structure elements for a richer description. From the functionality point of view, interface facilities and an API are provided to guide and make easy the creation of LO types. Furthermore, this organization of the metadata schema offers high flexibility for defining metadata sets and subsequently new LO types can be created. As all new types include the General Metadata Schema the existence of a minimum metadata set that follows the LOM definition is guaranteed, assuring the possibility of integrating the LO in another systems that understands the standard.

While metadata is seen by a part of the research community as a key feature for enhancing the search in digital repositories, the adoption of this solution raises other research questions. A well-known problem in the

TABLE 1. DEFINITIONS OF METADATA SCHEMA, LO TYPE AND LO

Field	Domain: an identifier. Range: string or vocubabulary or numeric types of an ortology.
MetadataSchema	Set of metadata fields
LO type	Set of metadata schemas that includes. at least, the "General Metadata Schema"
LO	Instantiation of a LO type that includes its metadata values plus "cntent"

information and library science literature is the metadata bottleneck i.e. once there is an agreement on the metadata fields, how this metadata is created? Three ways have been identified: 1. The author of the resource creates the metadata using editing tools 2. A professional cataloguer creates metadata (as librarians currently do) and 3. Automatic generation of metadata. The first way, fully user generated metadata, does not seem a workable approach for learners, not even for teachers. The second one involves cost and scalability issues. While the third one, mechanisms to automatically extract metadata field values, and by extension, other semantic related values, is a promising approach we will elaborate on.

A key feature of an LO type, is the possibility of declaring the mechanism to be used to fill automatically each metadata field. Currently three methods are considered: 1. Extract the value from the user session context, 2. From information provided by an external tool or 3. By inference rules in the case where an ontology is provided. In the first prototype of the LOR, the portal and the LOR were an integrated set. In this case, the session variable played the role of user profile storing data about the context of the user (such as current project, activity and group of the user, language in the system, etc.) This was used for filling some fields of the General metadata Schema when a LO was created from the portal, thus the form shown to the user when selecting the add option, provided these fields already filled. In the case of an LO created through a tool, a request (using the Web services interface) to the portal for the session data provides this information so that both the general metadata set and the specific metadata created by the tool itself were filled, according to the application profile defined for that tool. Then, the LO was stored in the LOR. A library has been implemented in order to provide the interaction mechanism for tools asking for the session data and for storing LOs into the LOR.

In the last version, the portal and the LOR are separated services. This library has been modified for achieving a more generic automatic process of metadata generation [Verdejo et al, 2006 B]. In order to get it, the adopted solution is to declare as part of the LO type the methods to be used to extract values for a field: mapping from the models of the portal, from a tool, from a system function (for the date for example).

There is a well-known trade-off between expressivity and portability when working with metadata and ontologies, so at the moment inference methods are not considered in the LOR service standard version.

2.1 The LOR in the Technological Infrastructure

The main characteristic of the LOR, and what makes it the backbone of our networking infrastructure, is that it provides mechanisms for external tools to take advantage of its storing and retrieving facilities in an adapted way. Although the LOR incorporates a portal as a web interface for accessing the repository objects, its most important feature is the tool-adapted persistence mechanism which it grants through web services for uploading, retrieving and searching the stored objects from any computer tool. Many diverse tools can be potentially integrated in the networking infrastructure, via these LOR's web services, furthermore a "wrapper" approach, using our CARDS tool, is also provided for those tools not prepared to interoperate directly with the LOR's external interface [Verdejo et al, 2006 B].

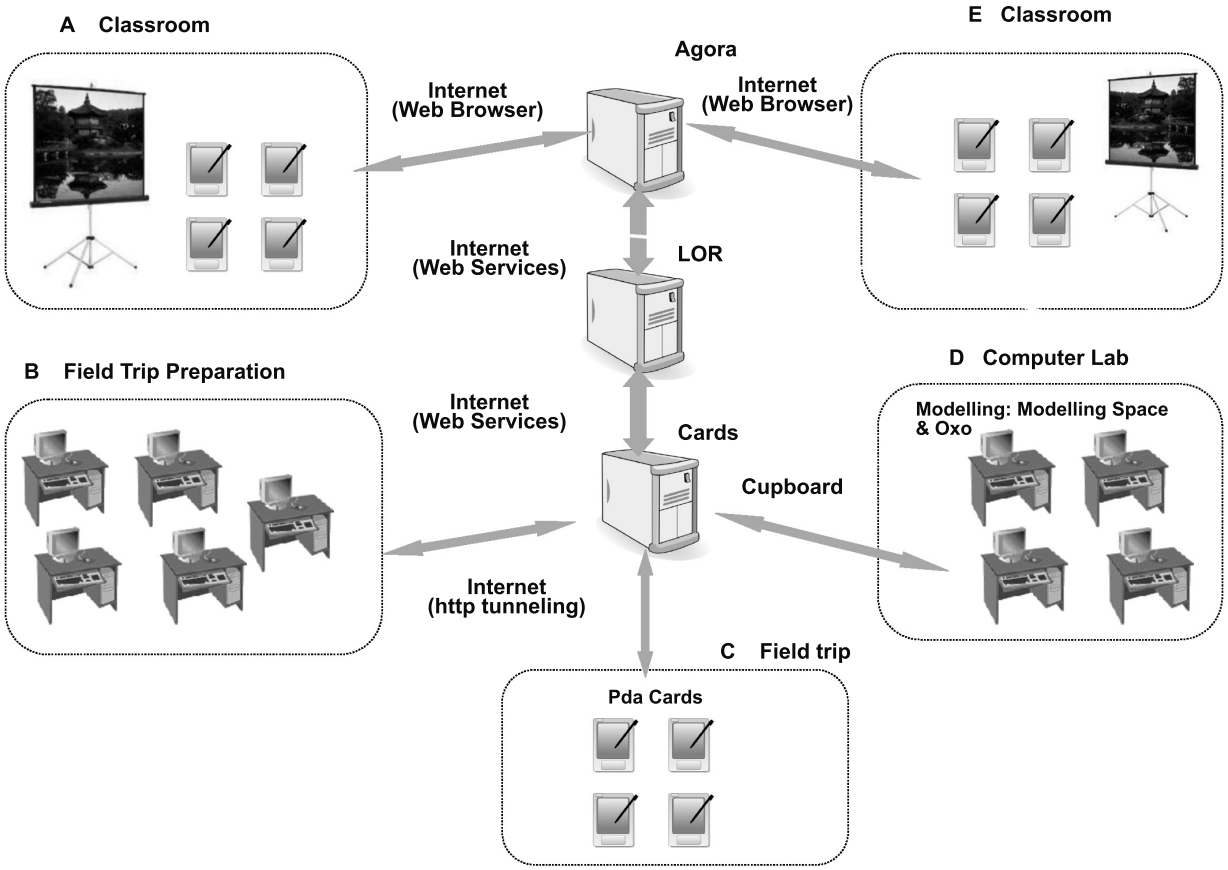
CARDS is a data collection tool as well as an authoring system for defining models for data collection and the metadata associated to these models. In addition, CARDS can be seen as a metamodeling system for wrapping other tools products. It allows importing and exporting data in different formats, acting as a bridge to the LOR functionalities for those standalone applications not able to generate descriptions for their input/output. Therefore, CARDS is a general purpose tool providing functionality for

- Creating models for data collection, tests, activities,
- Instantiation and differentiation: Teachers, students and monitors are able to create new types of nature cards and activities that combine several of these, by just instantiating and stating parameters from previous ones
- Aggregation: students can apply transformations and combinations of data to generate new objects.
- Exchange of objects with the LOR, using web services.
- Mapping of data to output formats for tools with limited interoperability.

The design of the educational network has been driven to facilitate the flow and transformation of data and artifacts across scenarios, for all the actors involved in the learning activities. The LOR and Cards provide the support for interoperability, together with external tools and other tools developed in ENLACE provide potential for integration in a wide range of scenarios.

Figure 2 shows the configuration deployed for the activities described in the next section to illustrate our approach: The scenario A is the classroom where the teacher and the students carry out a training activity involving bird song identification, using *Agora*, a tool supporting presentation, discussion and voting. The scenario B is the classroom where the teacher and the students prepare the activities for the field trip, using *Cards* and a variety of sources of information. The scenario C is the field trip where students work mainly collecting data with the PDAs in standalone mode. However, there are two

FIG 2. TECHNOLOGICAL CONFIGURATION FOR ACTIVITY DEPLOYMENT



periods of connection with the LOR, at the beginning and at the end of the trip, where the cards to be filled are distributed as well as collected when they are filled. The scenario D involves students working in pairs, in the computer lab with a set of tools: ModelingSpace, OXOTool, and Cards, interacting with the LOR. Finally scenario E is a group activity in the classroom, to present results and select together a representative sample for the group work. In this case, using *Agora* interoperating with the LOR to select candidates and store the result.

Learning activities

In this section the set of scenarios represented in figure 2 will be described, to illustrate the approach.

3.1 Scenario A. First contact and warm-up activity

The activity starts with an initial session, which takes place in the classroom. In this session, students will learn to recognize the singing of the birds that will later be seen in the outdoor trip. We use for this purpose a multimedia content created by the SEO Birdlife organization: it features a data sheet for every bird, detailing its habitat, customs, special features and identification tips. It also includes pictures and sounds. After studying and discussing this information, several interactive tests are performed with the Agora voting software tool, which will be described later. In each test the teacher shows through the projector a set of birds, then plays the singing of one bird and requests the students to guess which is the bird that emits that sound. Each student vote for one bird using a handheld device, then the vote results are projected and the teacher leads a discussion about the results. This tests help to measure the students' bird identification skills. If the results are not as good as expected, the bird information can be displayed and studied again.

The inclusion of a technological background in this scenario is important as it provides the students a first contact with both the handhelds and the Agora tool, which will be used again later in the activity. In a voting context, the technology grants a formal and fair framework, while students feel handhelds both familiar and exciting. Besides, the results of the voting tests are stored in the LOR, as it will be explained later, and therefore the teacher can reuse the results. For example, once the whole activity has ended, the teacher could repeat the tests and compare the results in order to find out whether the outdoor trip has indeed been useful for improving identification skills or not.

Agora is a web tool developed in the framework of the ENLACE project. It is named after the place where the

magistrates and the citizens from ancient Greek polis gathered to discuss any issues, and then voted by raising hands. This tool allows the teacher to design and perform real-time vote sessions in a classroom environment in which some or all of the students are provided with a computer or a handheld; a projector is also required to guide the activity and show the results. The session manager module handles the design task, while the real-time performance is carried out by the web player module. There are two different roles considered: the teacher and the student, being the first one the only with access to the session manager.

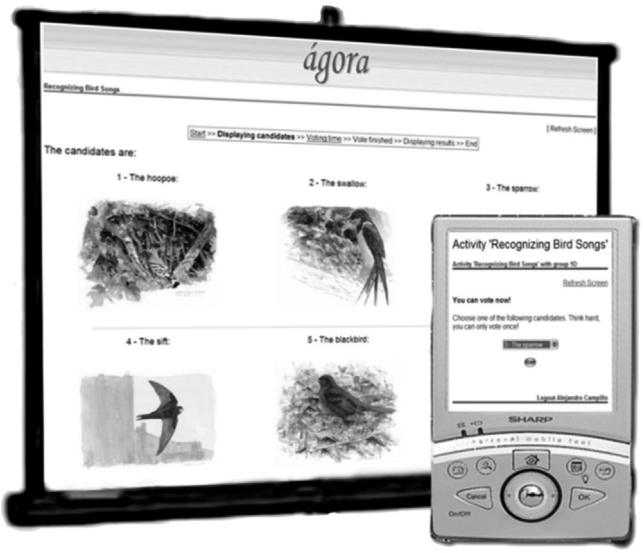
The purpose of Agora is to give technological support to a wide range of possible discussing and voting scenarios that can come up in an educative environment, from the election of the delegate of the classroom to a collective answer for a test question. Furthermore, the delegate election scenario can be different whether we assume that students will previously put themselves forward for the charge or just consider every student a compulsory candidate. Our approach is to consider two main factors that change between different scenarios: the nature of the candidates and the student participation in the candidate selection. These factors can be modified through the session manager interface.

The first issue has been faced by extending the concept of candidate in such a way that practically anything, including a learning object, can be a candidate. The idea is that any multimedia content can be a candidate: text and image candidates are supported as basic candidates. There is also a "URL" candidate type, allowing websites and external content to be a candidate and relying in the browser and the operating system to display them. The second factor is the student participation in the selection of candidates. Currently three modes of student participation are supported: in the first one, candidates are fixed by the teacher role and the students can't take part in the process. This is the default configuration, and it suits most of the voting scenarios, including the one described before (guessing which one of the displayed birds emits a given sound). In the second one the students can apply to become candidates; this is the typical configuration of election scenarios. Finally, in the third mode students can enter their own candidates before the voting session. An example of use case is the following: the teacher raises a question in the classroom related to the school curriculum. Students write their individual answers into the handheld as candidates. Then the teacher checks the received candidates, discarding inappropiate or redundant answers; if none of the students wrote the correct answer, the teacher enters and shuffles it among the students' answers. Finally the voting session is performed, the correct answer is revealed and a discussion follows analyzing the results.

Once the teacher has created and customized the voting session through the session manager, it becomes available to be performed in the classroom through the web player. The teacher role in Agora can switch between two different views: the teacher view and the projector view. The projector view is the default and is intended to be used with a projector, showing to the whole class the workflow of the activity, the current stage, the candidates, the voting results... The teacher view can be used occasionally and provides access to more detailed information (for example finding out which are the names of the students that haven't still voted, so that the teacher can give a verbal warning to them). The workflow is implemented in Agora as a state machine; depending on the configuration paramenters, the number of states and the possible transitions from one state to another could change. In the teacher or projector view, the workflow can be easily controlled through a simple menu that shows the current state and the possible states that can be accessed by clicking them. This simplicity allows the teacher to rely the workflow control on a student, who can act as an assistant. The workflow changes dynamically if, for example, a draw occurs, allowing starting a new voting stage to undo the draw.

The student view allows the student to follow the workflow and participate when the time comes to do it. For example, when the teacher switches to the "voting time" stage the student view is refreshed, asking the student to check the candidates in the projector and then vote through a combo box. As Agora is fully implemented as a web application, having the projector and students browsers synchronized to every event was an important issue to solve. We have used the pushlet mechanism [van den Broecke, 2002]; a JavaScript and XML based solution

FIG 3. AGORA PROJECTOR AND STUDENT'S VIEW ON PDA



that keeps the browser permanently listening to a given kind of event. An interesting feature of the pushlet mechanism is that events can be labeled, so that the projector browser can react to one kind of events, while the student browser can react to others. Figure 3 shows a picture of both the projector and the student (handheld) view.

3.2 Scenario B. Preparing the field trip

The vote session in the classroom allows students to become familiar with the sounds of the birds. The next activity is a field trip to a nature park called "El Monte de El Pardo" where they have to listen to birds and recognize them, filling an observation card with a PDA. To help them in this task SEO instructors follow them. SEO/Birdlife is an organization that strives to conserve birds along with their habitats and global biodiversity, by working with people to attain a sustainable use of natural resources. This organization runs field trips[2] for schools and for the general public, in areas of special ecological value.

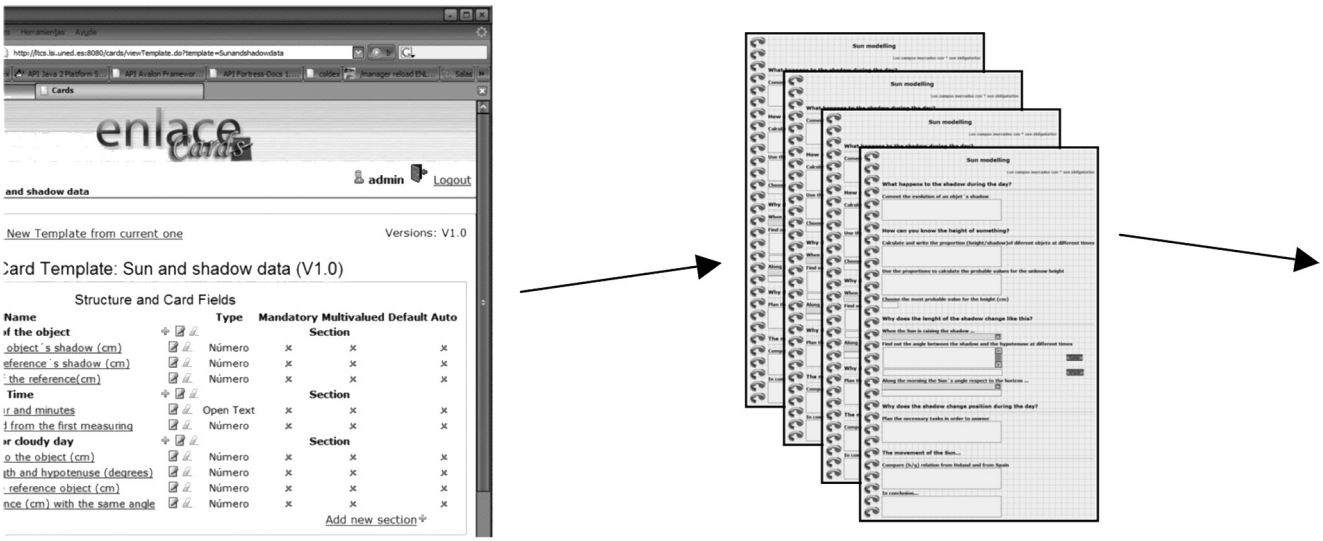
In order to prepare this activity there are two tasks to be performed either by the teacher, the students or both together. Firstly, they have to create the set of card templates that contains the questions and answering fields that students will have to fill during the field trip to collect data. Users have at their disposal the authorizing dimension of the tool CARDS (Figure 4, A). With this tool they can define the different fields each card template is comprised of. Each field can have a different answer type. In our concrete example, cards have a field representing the birds that the students have listened to. This field is a vocabulary type, which means there are several fixed options chosen by the teacher. Other fields of the card template are the GPS location where the birds are listened and the altitude of that location. Once the card template has been defined, it is saved by CARDS in the LOR via Web Services.

The next step is to create the activity (Figure 4, B). An activity in this context is a description and a set of card templates for data collection to be used by students to fill with the observations carried our in the field trip. These concerns data related to the habitat, including flora, physical measures, meteorological conditions, etc. These activity templates are also created with the Card application, and stored in the LOR for further use.

3.3 Scenario C. The field trip

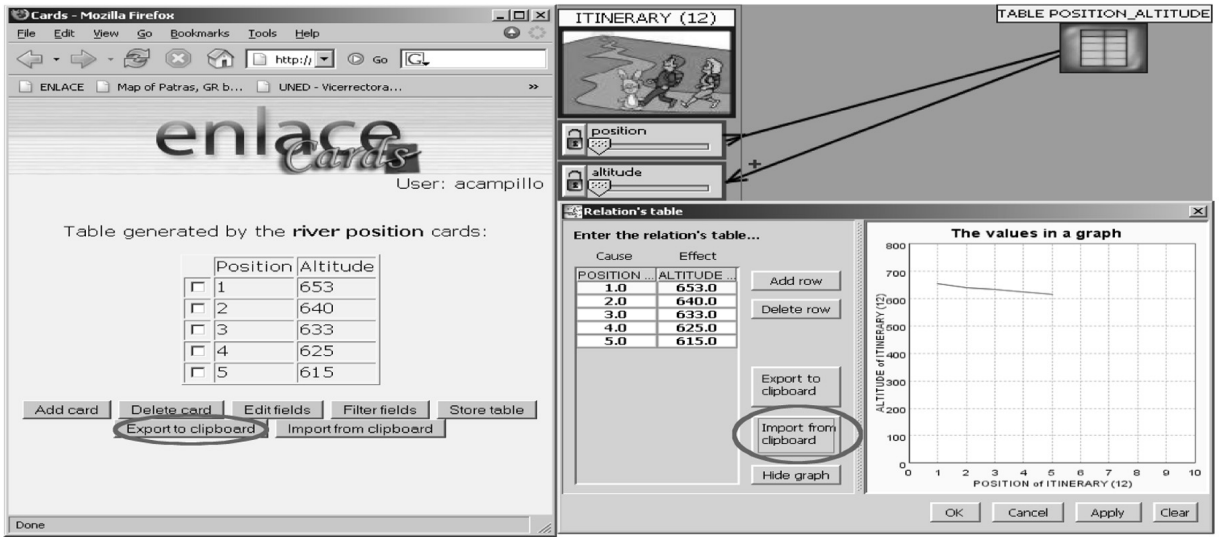
The created cards are saved in the LOR, so an Internet connection is needed. Because of the lack of this kind of connection in the nature park together with the WIFI card, which consumes a lot of battery power, a stand-alone application has been implemented (named PDACARDS). This application permits the same operations of the web interface of CARDS to fill a card. However, a permanent connection is no longer necessary, only for a short period of time at the beginning and end of the field trip. When PDAs are given to the students, they need to connect to the CARDS application in order to load the required background and forms for the chosen activities. After this initialization, students can collect their data with the PDA in a standalone mode.

FIG 4. PREPARING THE FIELD TRIP ACTIVITY



2 (http://obrasocial.cam.es/actividad1.asp?pActividad=68)

FIG 5. ENLACE CARDS TOOL (LEFT) AND MODELINGSPACE TOOL (RIGHT)



Once the first synchronization has been done, and with the students in the forest, they are organized in several groups, with a SEO instructor. After searching and choosing a suitable place, they stop to listen to the birds in absolutely silence. For this time they are filling the card with the name of the birds they think are listening to, and with the position they are in. They carry out other activities, collecting a variety of data, depending on the itinerary and the raised questions. The filled cards are stored in the PDA. The last synchronization occurs at the end of the activity and consists of uploading the filled cards from the PDAs to the LOR. The data is submitted, via http, to the CARDS application which makes a Learning Object with the card as content and adding as metadata information from the context session, like author, activity or date. After that the LO is sent to the LOR, via Web Services.

3.4 Scenario D. Analysing data and creating representations

Once students have finished the field trip activity where they have collected data about the birds and the habitat, they can analyse and elaborate the data to create different models, in order to justify the answers to the main research questions. For example, they can generate a topographic profile of the visited area and use this profile to situate their observations.

3.4.1 Generating an itinerary through the Cards tool data and the ModellingSpace tool

In order to create a topographic profile, a modelling tool is used for generating a graph representing the area in which students have collected their information. In this example, CARDS is used as a wrapper to import/export data for an external tool not interoperating with the LOR. This is interesting for mapping data to external tools such as ModellingSpace [Avouris et al, 2003], a collaborative modelling tool suitable for 11-13 year-old students allowing them to create their own models to represent and understand natural phenomena, physics laws, trigonometric rules, etc. Nevertheless, ModellingSpace only permits to import and export data from the clipboard, or interactively to type the data required, so CARDS is used as a bridge to the LOR for providing students with a seamless working flow.

This learning activity involves building a graphical representation of an itinerary using the experimental data collected by students and the ModellingSpace tool. First of all, students, using CARDS, have to search the LOR for their observations, analyse these cards, select and aggregate the relevant data into a position-altitude table, to represent each one of the reference points in their field trip path where they have gathered the birds' sounds information (left part of Figure 5). Then, they export this tabulated data to the clipboard, so it becomes accessible from ModellingSpace. Now, in the ModellingSpace tool, students have to create an itinerary entity, which includes the two variables (position and altitude), create a "table relationship" to link these two variables, and import the data from clipboard (right part of Figure 5). Once the table is filled with the values, they can visualize the path profile. This profile can be stored as an image file, which can be back sent to CARDS, and transformed into a LO with contextual generated metadata to be stored in the LOR for further use.

3.4.2 Working with a composition tool

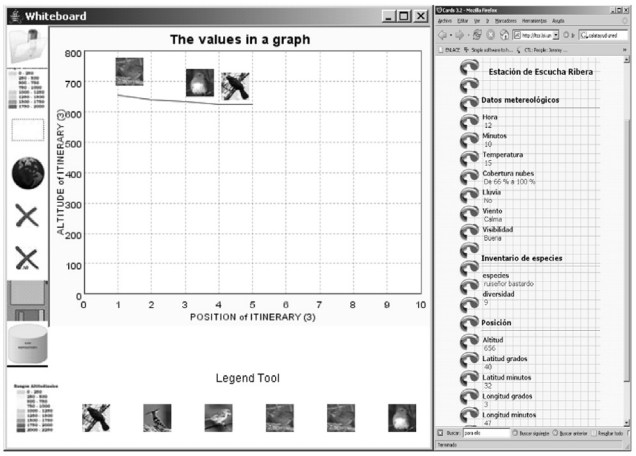
In this activity, students can use the profile they have created as a background for a habitat map with "active" birds icons, showing the LO complete information. OXOtool is another tool developed in ENLACE which provides functionality for aggregating "active" icons over a

background, to create a new composition object, in this example, a view of an habitat, with "active" birds icons.

OXOtool (figure 6) offers the following functionality:

1 Searching and Filtering objects in the LOR to create a candidate set. Figure 6 illustrates an interface snapshot of the selected observations in a field trip by the object type. In this example the type is "Listening Spot". Students can also filter by other metadata fields like date, school, observer, place, group, ecosystem, etc.
2 Associating objects with symbolic icons to create a palette. This is the "legend" that appears at the bottom (Figure 6).
3 Searching and importing an object from the LOR to be used as a background. Students have selected, in this case, the profile of the previous activity.
4 Selecting icons from the palette and situating them on the background. Here, students have situated the selected icons in the position where they have listened a particular bird: the object associated with the icon can be visualized (right part in Figure 6).
5 Finally, when students have positioned all the cards' icons in the background, they can store the composed object (background and icons) as a new object in the LOR.

FIG 6. THE OXO TOOL



3.5 Scenario E: Choosing a representative profile

The last step of the learning activity takes place again in the classroom. At this point, the different objects representing the habitat profiles built by the students are stored in the LOR. In this last session, students will use again the Agora voting tool to choose which profile is more accurate and should therefore turn into the classroom representative: this profile will become a new learning object and will be stored in the LOR.

Following one of the guidelines of the ENLACE project, the goal of Agora is not only to allow the performance of voting sessions in a technological scenario, but also to integrate these sessions within a long-term educational scenario. This means that student created artefacts must be able to be integrated in Agora as input (candidates), but also that new content should be created as output after the sessions.

In fact, when the teacher or the students are adding candidates, Agora offers them the possibility of retrieving objects from the LOR and uses them as candidates. This communication between Agora and the LOR is held through web services; it's interesting to point that Agora doesn't need to understand the format or the content of the cards: it just manages them as candidates, and when the time comes to display cards on screen it relies on the CARDS visualization web services, keeping the relationship between the tools loosely coupled.

When looking at the potential output, a question raises: what is interesting to store from a voting session? Depending on the nature of the session, it could be interested to keep the winner, the student participation for evaluation purposes, the candidates proposed by the students, or maybe the time the students needed to come to an agreement. The Agora approach is to generate a new card using the CARDS authoring tool, storing all the session information, and then relying on the teacher or in third party applications to extract the desired data. This card is generated when a session ends, and it stores everything related to it, from the names of the participants to the winner candidate. All text and image candidates are included in it, but for imported candidates (such as websites or cards) only their reference is stored.

Conclusion

The set of related scenarios described in this paper are a representative example of our approach to offer and integrated technological framework for ubiquitous learning. We have shown how students can actively create and reuse data and artefacts, using a variety of tools, either in individual or collaborative mode. In the ENLACE project, we focus on this integration aspect, and so we use external tools, and create our owns, especially to provide the necessary "glue" for interoperability. This is the case for Agora, Cards, and OXO tools. Agora takes student artefacts as input and then produces a new artefact as output, relying on CARDS for information exchange and in the LOR for managing the storage of educational artefacts. Examples of other external tools that we have also tested are Coolmodes and TreeDatabase. There is a number of challenging technical issues open for future work; currently we have started to work on autoconfiguration and personalization of the network for a particular scenario.

Acknowledgement

ENLACE Project is partially funded by the Spanish Research Agency, MCYT, grant TIN2004–04232. Carlos Celorrio acknowledges PhD grant BES-2005-7178.

References

Avouris N. et al, 2003. Modellingspace: interaction design and architecture of a collaborative modeling environment. *Proceedings of the Computer Based Learning in Science*.

Bellamy, R.K.E., 1996. Designing Educational Technology: Computer-mediated Change. *In B. A. Nardi (Ed.), Context and Consciousness: Activity Theory and Human-Computer-Interaction*, pp. 123-146, Cambridge, Massachusetts: MIT Press.

van den Broecke, J., 2002. Pushlets - Whitepaper. *Technical report Pushlets.com, 6 August 2002.* http://www.pushlets.com/doc/whitepaper-all.html

Celorrio, et al., 2006. Un Modelo de Distribución de Repositorios para un Portal de Comunidades de Aprendizaje Colaborativo. *IE Comunicaciones, Revista Iberoamericana de Informática Educativa*. No. 3, pp 27-42.

IEEE Standards Department, 2002. *IEEE 1484.12.1-2002, Learning Object Metadata Standard.* http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf.

Mayorga, J.I., et al, 2005. An Ontology-driven portal for a collaborative learning community. *12th International Conference on Artificial Intelligence in Education, Frontiers in Artificial Intelligence and Applications*, vol. 125, pp. 872-874, IOS Press.

Neven, F. and Duval, E., 2002. Reusable learning objects: a survey of Lom-based repositories. *Proceedings of the 10th ACM international Conference on Multimedia*. Juan-les-Pins, France, pp. 291-294.

Verdejo, M.F. et al, 2002. A System for the Specification and Development of an Environment for Distributed CSCL Environments. *Intelligent Tutoring Systems, 6th International Conference, ITS 2002*. LNCS, Springer-Verlag.

Verdejo, M.F et al, 2004. Designing a Semantic Portal for Collaborative Learning Communities. *R. Conejo et al. (Eds.): CAEPIA-TTIA 2003, LNAI 3040*, pp. 251-259, Springer-Verlag Berlin Heidelberg.

Verdejo M.F. et al, 2006 A. An Educational Networking Infrastructure Supporting Ubiquitous Learning for School Students. *Proceedings of 6th IEEE International Conference on Advanced Learning Technologies, ICALT 2006*. Kekrade, The Netherlands, pp. 174-178.

Verdejo M.F. et al, 2006 B. Improving Learning Object Description Mechanisms to Support an Integrated Framework for Ubiquitous Learning Scenarios. *Proceedings of Wireless, Mobile and Ubiquitous Technologies in Education, WMUTE 2006.*

CONTEXTUAL CUES: AIDING WIRELESS MULTIMEDIA COLLABORATIVE LEARNING

Michael Voong
Birmingham University
Birmingham, UK. B15 2TT
m.voong@cs.bham.ac.uk

Abstract
Psychological theories state that an increase in contextual overlap between the original learning situation and review should result in an easier recall methodology. We propose a system which uses the contextual cues of relative timing of the presentation of key points detected during a traditional learning class by mobile phones that learners hold. Cut-down versions of learning material are stored on mobile devices present at the location of the lecture; a choice made from observations of increasing consumer demand for shorter and shorter 'chunks' of information. The proposed system is implicitly linked with an online community system, accessible from the mobile devices, where learners can use the cues to more easily search for, revise, collaborate on and recall difficult learning material using the multimedia capabilities of their phones.

Keywords
m-learning, mobile, learning, context, communities, CSCL

Introduction
Our views of mobile phones as pervasive devices have enabled researchers to explore how we can educate ourselves outside of traditional contexts, making use of network connecting technologies to support learning wherever we are. However, traditional methods of teaching academic material will be used in the education system for some time, and we should not ignore research in this type of learning. This paper proposes a system based on psychological theories of optimising memory recall that suggests a way of improving existing learning scenarios using mobile devices with minimal altering of the traditional learning methods. We will show how the portability and the networking capabilities of mobile phones give them the potential to support learning practises where short spontaneous bursts of collaboration take place between fellow learners that would not be possible with traditional online learning systems and communities such as (Blackboard, 2004).

The remainder of the paper has been organised as follows: firstly a discussion will be made of existing research in m-learning, comparing two distinct types of systems. A discussion will then be made on why we should concentrate on exploring systems that take advantage of the social collaborative nature of learning as opposed to ones which simply replicate existing learning scenarios, albeit on mobile devices. A psychological theory of how context is linked with recall efficiency is described, and a system is proposed which takes advantage of mobile devices to promote spontaneous interaction and contextual cues to aid in recall and support collaborative learning.

M-learning systems
M-learning systems have been described in different ways. (Nyíri, 2002) describes them as platforms which enable "situation-dependent knowledge, the knowledge at which m-learning aims, by its nature transcends disciplines; its organizing principles arise from practical tasks; its contents are multisensorial; its elements are linked to each other not just by texts, but also by diagrams, pictures, and maps". (Trifonova and Ronchetti, 2003) summarises existing m-learning systems and organises them into two distinct groups. One group, called "**accessing content**", includes the Ultralab M-Learning project (Ultralab, 2003), which in its infrastructure includes a learning management system that enables the learner to access a range of material using mobile devices.

A second group, "**communicating and interacting with people**", lists projects that *bank on the social collaborative nature of the way people learn, aided by mobile technology*, which is supported by Nyíri's philosophy on m-learning as being "learning as it arises in the course of person-to-person mobile communication" (Nyíri, 2002). It includes the UniWap pilot project (Seppälä et al., 2002), which breaks away from the traditional methods of teaching by reaching out into the physical space. Messaging services enable learners and teachers to interact with each other outside of the classroom, and by doing so promotes learning in real-life situations. The project motivation is that mobile technology enables students to learn in whatever situation suits them, and that students should be able to find guidance wherever they are.

The HandLeR project (Sharples, 2000; Sharples et al., 2002) is an attempt to gain an in-depth understanding of the process of learning in different contexts with the evaluation of a handheld learning device. The system is "...intended to support children to capture everyday events such as images, notes and sounds, to relate them to web-based learning resources, to organise these into a visual

knowledge map and to share them with other learners and teachers" (Sharples et al., 2002). Systems of this kind promotes learning in complex environments where learning goals depend on a contextual factor, such as the route a learner has taken in a history museum, or the surrounding resources and co-learners.

The latter group of the two is the one which is of greater significance to m-learning researchers (Roschelle, 2003), as the systems do not simply make existing learning material accessible on mobile devices, but take advantage of the mobility of the devices and the change in context of learners. We must concentrate on studying social practises and improving learning efficiency, not the technology itself.

A system designed to enhance the collaborative learning experience must start on the basis of having a clear view on learning social practises. For example, a project at Kingston University (Stone et al., 2002) studied a system which used two-way SMS communication in a campaign for a UK youth brand. They believe that SMS could be used to facilitate creativity by providing a timely means for interactivity to learners. The reasoning behind this belief is the way we work with SMS; people find it more personal, which might be explained by the observation of users reacting with a mean response time of 17 times shorter than web methods. Simple communication technologies such as SMS has been developed by youth users into rich social practises (Rheingold, 2003), highlighting the potential of flexible m-learning systems.

(Dimitracopoulou, 2005) summarises studies of community-based learning systems and found that in formal and informal studies students preferred embedding collaborative comments in the context of the subject of discussion because it makes it easier to refer to parts of the artefacts and prevents the cluttering of comments by effectively assigning them contextual labels. Dimitracopoulou refers to these tools as "embedded communication tools". The range of these tools include the annotation engine evaluated by (Nokelainen et al., 2003), which enables users to highlight and annotate web documents recommended by course instructors as being relevant to learning topics. In this case, empirical results showed that self-made annotations were said to be more useful than annotations made by other users. This is likely to be due to users scaffolding new knowledge upon their personal, internal models of the current world, and then commenting on the relationships. A further, more detailed study is yet to be carried out to confirm the reasons behind this result in more detail, but we can fairly say that learning habits still heavily involve self-annotation; collaborative learning systems should not ignore that for many students, it is a very important part of the learning process (Nokelainen et al., 2003). A further result from the paper showed that students make no distinctions between annotations made by anonymous users and named users. This suggests that there may be less of a community atmosphere in the system studied, but a further study would have to be carried out to see whether the results were specific to the type of implementation.

Contextual cues

Tulving's theory of encoding specificity (Tulving, 1983), regarding retrieval of an item from memory, says that "*The probability of successful retrieval of the target item is a monotonically increasing function of informational overlap between the information present at retrieval and the information stored in memory*". If the theory is correct, we could increase the learning efficiency of a student by providing them cues to the original place they had originally been exposed to the topic. For example, taking an exam in the same place you had lectures in on the same topic, or recreating the scents of the original room (Herz, 1997).

The pervasive identity we habitually carry around with us - the mobile phone, could be used to provide an additional contextual layer that could help with retrieval of learning material. It would be interesting to discover which contextual cues would help the most. We can design an experimental framework which takes its basic features from systems like (Blackboard, 2004), which is a large framework built up of instructional tools, collaboration and communication systems and tools for assessment and evaluation; and augment cues using the mobile phone as a sensor device. Several possibilities can be suggested: targeting visual memory by attaching photographs of lectures, including the instructors, to course summaries and notes; inferring and recording the proximity of fellow students in classes where physical collaboration is used in a learning exercise; or attaching time labels to specific parts of course summaries.

The proposed system

A proposed system can be described as follows: students who have attended a lecture or class receive a copy on their mobile phone of key points that the instructor labels as important, which should be reviewed later. To support this, a plugin or tool installed on the teacher's Bluetooth-enabled computer would make it easy to highlight important points in the teaching material. During the presentation, the broadcasting of the key points together with a **timestamp** will take place parallel to the presentation of the related material. Software on the student's mobile phone would collect these notes in a pervasive, unobtrusive fashion. (Kendall and Kendall, 1999) described such systems as Á-push information delivery systems, where the provider *thinks* they know

what the users would be interested in. However, filtering is an implicit part of the system because the receiver is assumed to be interested in information directly related to the class material. Such a concept is not unlike RSS (RSS Advisory Board, 2006), which has been discussed to be useful for education as a syndicated and filtered information source (Harrsch, 2003). (Beale, 2005) observes that information is being presented in smaller and smaller forms on the Internet, using RSS as one example. He argues that the society acceptance of shorter and shorter chunks of information means that it has become a powerful way of organising information for display on mobile devices.

Spontaneous multimedia collaboration

Due to the system being available on the mobile devices, there is the possibility that more spontaneous interactions, meetings and collaborations would take place. The multimedia capability of the phones and the rise in popularity of WiFi-enabled phones means that video collaboration on course material would be technically possible. Students can exchange ideas in this way, and by making it easier to access course material and communicating with fellow colleagues, the process of learning may be more *spontaneous* and *enjoyable*. In line with (Nokelainen et al., 2003)'s research that showed students finding notes made by themselves important as well as collaborative annotations, such a system could enable learners to annotate the supplemental notes electronically, with voice clips, multimedia from either themselves or fellow learners. For example, a student on a Japanese course may be revising their grammar at home when they think of an excellent example that illustrates a grammatical rule they learned the previous week. They could easily refer to the original class structure where the rules were taught, and add to the example with a voice clip. Making the clip immediately accessible would mean that fellow students could start using the additional example and help each other by bringing up questions. Learning out of the context of the class has been said to have large advantages depending on the type of learning (Jones et al., 2001; Sharples et al., 2002). Learning a language is one good example, as it is something you must learn by *doing*, not just by being shown it.

The student would find the original notes easier because on their phone they can search what has been covered in class by date. The system could supplement the information with the timestamp, visualised as a cue of the relative timing of the actual presentation during the class, which could aid recall of learning material due to the increase in contextual overlap between the original class and the timing seen on the visualisation (Tulving, 1983). It would also make it easier for users to find summaries without manual labelling of the date the material was originally covered. The design of the visualisation itself is for future work, but inspiration can be drawn from the Dance Dance Revolution arcade and console games by Konami (Konami, 2006) where a uniformly moving timeline denotes relative change in time, with time signature cues indicated with periodically displayed lines. These cues can be incorporated automatically in both the mobile software and the online versions of the notes.

Broadcast messages could also include information of the occupants present in the class which would also further increase contextual relation. A version of the lecture material would be automatically published online, accessible from the mobile devices, together with the summarised key points, allowing attendants to collaborate with each other by discussion. Finding the material would be easy, as the location would be transferred to the mobile devices as part of the pervasive broadcasting of messages during classes.

Technical design

The main technical implications of the system are how to integrate the summary message creation tool into the teacher's workflow and how to efficiently multicast the messages to hundreds of students using the proximity-based Bluetooth protocol. The first would have to be further worked on by surveying how teachers present their learning material, and the latter can be solved using Bluetooth multicasting techniques such as the one discussed in (Wang, 2005). An implementation of a working prototype would be very interesting for m-learning researchers for two reasons: a) we do not know how such a general system would be used in terms of collaboration patterns between students linked together in a way not unlike social networks. An ethnographic study of this may reveal interesting social learning patterns; b) most of the previous m-learning applications have been concentrating on the ways that we can represent learning material on a mobile device. This system would give us a detailed view on how people start collaborating when given tools which allow for easier virtual collaboration and the processes that they go through to increase their learning potential in the real world. The pervasive manner of the system means that it would not break the flow of normal teaching methods; it could be used as an addition to the learning process.

Conclusion

We have proposed a system drawing inspiration from a psychological theory on memory recall, previous research in m-learning on the way people learn socially, lessons learned from existing web-based note annotation systems and visualisations seen in video games. The system can be described as taking inspiration from both the ideal m-learning systems, where the whole philosophy of

traditional learning is changed (Nyíri, 2002) and collaborative learning community systems (Dimitracopoulou, 2005).

The system makes use of tool installed on the course instructor's computer which is used to annotate key points on learning material to be presented in class. Students install a piece of Bluetooth-enabled software onto their mobile phones which receives in a timely manner the key points broadcasted by the course instructor's computer as the presentation proceeds. This serves two purposes: a) the student can review course material outside of the class without access to a computer terminal; and b) the timestamps on the messages, made possible by the mobility of the receiving devices, implicitly label the relative time that the material was presented, making it easy to find, annotate and discuss the subjects. A space for collaborating on the learning material can be easily placed on the web due to the integration with the presentation software, and the multimedia capabilities of modern mobile phones make dynamic and spontaneous virtual learning collaborations possible.

References

Beale, R., 2005, Information Fragments for a Pervasive World. *Proceedings of the 23rd Annual International Conference on Design of Communication: Documenting & Designing for Pervasive Information.* pp. 48-53.

Blackboard, 2004. Blackboard. *http://www.blackboard.com. Accessed 25th November 2006*.

Dimitracopoulou, A., 2005, Designing Collaborative Learning Systems: Current Trends & Future Research Agenda. *Proceedings of the 2005 Conference on Computer Support for Collaborative Learning.* pp. 115-124.

Harrsch, M., 2003. RSS: The Next Killer App for Education. *The Technology Source. http://ts.mivu.org/default.asp?show=article&id=1034. Accessed 25th November 2006*.

Herz, R., 1997. Emotion Experienced During Encoding Enhances Odor Retrieval Cue Effectiveness. *The American Journal of Psychology*, Vol. 110, No. 4, pp. 489-505.

Jones, V., Coast, G., Qld, A., Cranitch, G. & Jo, J. H., 2001, Hyweb: A Hybrid-Web System for Delivery and Enhancement of Web-Based and Traditional Teaching. *AusWeb01: The Seventh Australian World Wide Web Conference.*

Kendall, J. & Kendall, K., 1999. Information Delivery Systems: An Exploration of Web Pull and Push Technologies. *Communications of the Association for Information Systems*, Vol. 1, No. 4es.

Konami, 2006. Music in Every Direction. *http://www.musicineverydirection.com/. Accessed November 2006*.

Nokelainen, P., Kurhila, J., Miettinen, M., Floréen, P. & Tirri, H., 2003, Evaluating the Role of a Shared Document-Based Annotation Tool in Learner-Centered Collaborative Learning. *Proceedings of The 6th IEEE International Conference on Advanced Learning Technologies.* pp. 200-203.

Nyíri, K., 2002, Towards a Philosophy of M-Learning. *Proceedings of the IEEE International Workshop on Wireless and Mobile Technologies in Education.* pp. 121-124.

Rheingold, H. 2003. *Smart Mobs: The Next Social Revolution,* Basic Books, Place Published.

Roschelle, J., 2003. Keynote Paper: Unlocking the Learning Value of Wireless Mobile Devices. *Journal of Computer Assisted Learning*, Vol. 19, No. 3, pp. 260-272.

RSS Advisory Board, 2006. RSS 2.0 Specification. *http://www.rssboard.org/rss-specification/. Accessed 25th November 2006*.

Seppälä, P., Sariola, J. & Kynäslahti, H., 2002, Mobile Learning in Personnel Training of University Teachers. *Proceedings of the IEEE International Workshop on Wireless and Mobile Technologies in Education.* pp. 136-139.

Sharples, M., 2000. The Design of Personal Mobile Technologies for Lifelong Learning. *Computers and Education*, Vol. 34, No. 3, pp. 177-193.

Sharples, M., Corlett, D. & Westmancott, O., 2002. The Design and Implementation of a Mobile Learning Resource. *Personal and Ubiquitous Computing*, Vol. 6, No. 3, pp. 220-234.

Stone, A., Briggs, J. & Smith, C., 2002, Sms and Interactivity - Some Results from the Field, and Its Implications on Effective Uses of Mobile Technologies in Education. *Proceedings of the IEEE International Workshop on Wireless and Mobile Technologies in Education.* pp. 147-151.

Trifonova, A. & Ronchetti, M., 2003, Where Is Mobile Learning Going? *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2003.* pp. 1794-1801.

Tulving, E. 1983. *Elements of Episodic Memory,* Oxford, Place Published.

Ultralab, 2003. Ultralab M-Learning Project. *Project website. http://www.ultralab.ac.uk/projects/m-learning/. Accessed October 2006*.

Wang, S. Y., 2005. Scheduled Shared-Tree Multicasting for Bluetooth Networks. *International Journal of Wireless and Mobile Computing*, Vol. 1, No. 1, pp. 78-84.

THE SEVEN 'C's - NO, EIGHT - NO NINE 'C's OF M-LEARNING

Jocelyn Wishart
Graduate School of Education
University of Bristol
j.m.wishart@bristol.ac.uk

Abstract
Unless we have a clear understanding today of how and where tomorrow's technology can be used to support effective learning, educational developments will continue to be technology driven rather than learner driven. This paper identifies theories from the fields of cognition and educational psychology that can usefully be employed to explain the interactions between the user and their mobile device in a variety of mlearning contexts. In particular, examples from projects conducted at the Graduate School of Education (GSoE) involving trainee teachers and students in science using handheld PDAs are used to illustrate pertinent teaching and learning opportunities.

The theoretical approaches that appear to be most relevant to mlearning are those that stem from the constructivist approach to learning, involve learner control and challenge by setting an appropriate level of complexity, provoke their user's curiosity and allow them to engage in active learning conversations with a sense of confidence as they come to know and understand. Furthermore, mobile devices enable context aware and collaborative learning which offer opportunities for further engaging students and enhancing their learning. Building these concepts into software and activities designed for mlearning will support and motivate future learners.

Whilst acknowledging that mobile devices have a key role in supporting informal, serendipitous learning at point of need; the paper itself focuses on theoretical underpinning for the future successful use of mobile technologies within the formal school and university based curricula.

Keywords
Mobile learning, PDA, handheld computer,
constructivism, cognitive theory, conversational learning

Relevant theoretical approaches for m-learning

Constructivism
Naismith et al (2004) introduced a classification of mobile learning activities where they categorised examples of learning via personal digital assistants (PDAs) and mobile 'phones that involved children and the general public as well as university and college students, into six areas, four of which relate to the underpinning learning theory. These are behaviourist, constructivist, situated and collaborative. Two further categories relate more to context and application; informal and lifelong learning, and learning and teaching support. Of these six, I believe the constructivist approach is most helpful in terms of describing learning with mobile devices. Behaviourism considers only the relationship between a student's action and the response they receive without acknowledging any intermediary cognitive processing. And for me, situated and collaborative are more descriptions of ways in which learning may take place that could themselves be built into a constructivist learning activity rather than grounding theories within themselves.

The constructivist approach to learning is based on Piaget's (1950) original descriptions of how a child constructs their own understanding, building on previous understanding, and is currently predominant within the UK education system. The UK National Curriculum itself is based upon Bruner's (1966) ideas of a spiral curriculum where topics are revisited in turn at different ages in order to build upon previous learning. Papert (1980) himself built further on these ideas when he applied Piagetian theories to children's learning with computers to create the concept of constructionism. Constructionist learning involves the learner making their thinking explicit by, for example, designing a program in LOGO. This also allows the learner to see the results of their thought processes making it easier to revise or 'debug' them and, hopefully, building metacognitive skills.

Mobile devices lend themselves to constructivism, initial teacher training (ITT) students on teaching placement using PDAs would make notes in separate files, and later, through a process linked to further research and reflection, reconstruct those notes into a reflective essay

demonstrating their learning (Wishart, Ramsden and McFarlane, in press).

The effectiveness of these kinds of activities is reinforced by this student's report "During teaching practice I have found myself constantly bombarded with new and noteworthy information (e.g. scientific facts, ideas for teaching approaches, school procedures, evidence for QTS standards etc.). The PDA has allowed me to keep meaningful notes of this information, and structure the information in a way that allows me to access it easily.".

Another good example of PDAs being able to scaffold students constructing their own understanding is the use of Sketchy by school students. Whyley (2006), director of the Learning2Go Project where more than a thousand students in the UK have been using PDAs to support their learning lists Sketchy as a killer application for PDA use. He describes it as "A superb "Flickbook" animation tool, which learners enjoy using to illustrate their understanding of science concepts and other ideas". Constructing an animation is particularly helpful in supporting understanding dynamic concepts in science.

Control

Papert (1980) also attached importance to the concept of the learner 'owning' the problem making the activity of constructing personally meaningful. This sense of increased engagement of the learner controlling their learning by means of information technology has been noted for a while but not yet investigated on a large scale. In an early review of the use of databases in classroom practice Underwood (1994) linked valued learning experiences with ICT to the ways in which students take responsibility for the learning outcome and pointed out how new technologies could support a move to more independent approaches to learning. In fact using software to provide an open learning environment, encouraging student autonomy and choice, has seen as good practice in ICT teaching in the United Kingdom for a number of years now (NCET/NAACE, 1994). Davis et al (1997) argued that the degree of autonomy that secondary school pupils had over the pace and content of their learning with ICT was directly related to an increase in the quality of learning itself.

This was tested empirically by Wishart (1990) who investigated the effects of the three cognitive factors; user control, challenge and visual complexity on motivation to use and learning from an educational computer game. The game itself was intended for use by young children, written for the BBC micro and illustrated how to get out of a house fire safely. 300 primary school students played different versions of the game which had been constructed to provide user control of movement through the house, challenge through scoring points and visual complexity through use of graphic effects in different combinations. Control through user choice was found to be the most significant factor in creating involvement with and learning from the software.

Jones (2006) in Sharples' report on the Kaleidoscope big issues in mobile learning workshop described the importance of control as a feature of the relationship of users with their mobile devices. In particular she noted the relationship between control and the strength of association between the use of mobile devices and informal learning. Learners often find their informal learning activities more motivating than learning in formal settings such as schools because they have the freedom to define tasks and relate activities to their own goals and control over their goals. There are now many examples of PDAs being used to support informal learning within the UK. These include Caerus in the University of Birmingham's botanical gardens, the Tate gallery in London, Mobile Bristol and the Queen's Square riots.

Young children in the schools participating in the Learning2Go project are controlling the PDAs in and outside school with ease. The teachers in this project in Wolverhampton, UK are reporting that these students are doing more work at home and bringing into school more information gathered outside school than before they were given the mobile devices (Whyley et al, 2006).

As well as a sense of autonomy over when and where to learn feeling in control of the device clearly matters. One of the ITT students testing a Palm OS device in the first GSoE PDA project (Wishart, Ramsden and McFarlane, in press) was so frustrated by her inability to operate it in the way she wished to that she reported "I feel pure hatred for my Treo – it beats me every time." More usually the simplicity with which PDAs could be controlled was viewed positively by the ITT students who cited the 'instant on' feature, the multiple functions such as alarm clock, remote controller, camera and the variety of input mechanisms as benefits. Also controlling the physical presence of the device itself; being able to hide the PDA in a pocket or handbag when not needed was reported favourably by the students compared to other sizeable computers that could get between them and the class.

Conversational Learning

Interestingly Jones (2006) also referred to cybernetic theory pointing out that adjusting or controlling your role in a system is empowering. It was the cyberneticist Gordon Pask (1976) who originally considered learning as a system. He did not distinguish between human- human and human-machine systems but considered interaction in both as a dynamic process, in which the participants learn

from and about each other. Pask (ibid) put forward a view of learning as a conversation within such a system.

When applied to mlearning this concept of a conversation both reinforces and illuminates the process of coming to know by constructing knowledge in a two-way interaction between student and mobile device (O'Malley et al, 2005). Sharples (2003) points out that there are two possibilities for the role of the mobile device within this interaction or 'conversational space'. One possibility is for the computer to take the place of the teacher as in traditional computer-aided instruction. The problem is that it only covers part of the conversational space as even expert tutor systems are limited by their algorithms and cannot explore students' misunderstandings in any detail. An alternative is for the technology to provide an environment that enables conversations between learners. This extends the range of learning activities into other worlds through games, software models and simulations and to other parts of this world by using the PDA as a means of communication, through phone, email and computer based discussions.

Sharples (2003) adds that a mobile learning device can assist conversational learning by integrating learning descriptions across different locations and by holding the results of learning actions for later retrieval and reflection. The ITT students in the GSoE PDA project (Wishart, Ramsden and McFarlane, in press) stored notes and observation in both Word and Calendar for use in reflective assignments.

The concept of the computer as a communication channel enabling highly interactive conversations was first proposed by Pea (2002). He also noted the importance to the learner of access to stored data such as archives of information, knowledge, and representations of past activities that can be read, drawn upon, and extended as needed. Pea (ibid) proposed that, through such channels, information technologies have the potential to act as cognitive tools for augmenting human performance in complex tasks and for learning. Thus by considering the learner and the technological tool such as computer or mobile device as a single system we have a model where the information to support cognitive activities is distributed between the learner, the computer's memory and the internet.

Pea (1993) had already suggested that the use of information and communications technology (ICT) affords distributed intelligence. Perkins (1993) aptly described such working as 'Person Plus' and the GSoE study (Wishart, Ramsden and McFarlane, in press) showed that with an internet enabled PDA the ITT students did indeed become 'Teacher Trainees Plus'. In that study the software applications most able to support Perkins' (ibid) notion of 'person plus' were the calendar or diary scheduler for organising yourself, the spreadsheet of attendance or mark book for organising your pupils, the web browser to answer yours and the pupils' questions and the use of a word processor to make notes on information and events immediately they are encountered.

Motivation to Learn with Mobile Devices

Challenge, Curiosity and Complexity

Bruner (1966) noted the importance of intrinsic motivation for learning in describing his technology of teaching, and proposed that the will to learn consists of both curiosity and the drive to achieve competence. These are produced, respectively, by the complexity and challenge of the task at hand. Later Malone (1981) applied both these concepts to explain the high motivation found in computer game players.

Malone (1981) explored the importance of cognitive, intrinsic rewards within the software as he analysed what makes educational computer games so involving for the player. He considers that the challenge of an educational software program is made up of a number of goals which vary during the program thus maintaining uncertainty within the user as to whether they will achieve them. When computer games of the 1970s were assessed by American schoolchildren the presence of a clear goal produced the highest correlation with popularity. This was closely followed by whether the game kept a score which also provides further challenge. Malone adds that complexity created by the use of graphics and sound motivates the computer user through evoking curiosity to explore the software. Pupils using a multimedia application whether on a desk top or a handheld can be seen to be satisfying this visual or sensory curiosity to see what images and sounds there are as well as following up their cognitive curiosity to know more about a topic. Malone (ibid) also considered the presence of a coherent fantasy intrinsic to the game being played to be important but this is less pertinent to the everyday use of PDAs for learning and teaching support in schools and colleges.

A good example of software that has been seen to evoke each of challenge, sensory and cognitive curiosity in users is the wildlife identification guide Wildkey. On trials with 23 schools across SE England 100% of the school teachers involved agreed or strongly agreed that using handhelds running Wildkey for wildlife identification and location reporting motivated their students (Bailey, 2006).

Confidence

Lepper et al (1993) noted that the motivational goals of feeling challenged and feeling confident are linked. An expert system devised to teach should ensure its students

maintain a perception of self-efficacy for feelings of confidence and self-esteem have long been linked to successful learning.

Participants of all ages have been reported as confident in their use of PDAs, from 9 year olds in the Learning2Go project (Whyley et al, 2006) to sixty-plus year old nurses (Treadwell, 2005). The ITT students in the GSoE project (Wishart, Ramsden and McFarlane, in press) reported a feeling of confidence connected with having access to the internet wherever they were via PDAs. The search engine Google was particularly useful in this respect as it was simple and quick to use and the information returned with each hit was usually enough to answer the immediate query. On at least two occasions student reported feeling good about gaining the respect of teaching staff as having the PDA enabled them to retrieve information their mentors needed but could not themselves obtain.

Collaboration

Increased confidence can also linked to opportunities for using the handhelds for collaborative learning. Ramsden (2005) found in his study of undergraduate Economics students that having a PDA allowed the students to hold question and answer sessions via an online discussion board during lectures. The students reported that they found this particularly helpful and Trinder (2006) suggests such PDA use could be particularly supportive for students with confidence difficulties who, in addition to having an open discussion board, could also beam their peers privately with their questions.

One of the ITT students in the GSoE project (Wishart, Ramsden and McFarlane, in press), a Physics specialist, was being asked such complex questions about the biology of the heart in a lesson he was teaching he passed the students' questions on to his medical student friends via MSN.

A particularly successful example of collaborative learning amongst children through the use of PDAs has been developed by Miguel Nussbaum and colleagues at the University of Santiago in Chile. This is now being trialled in Wolverhampton schools as the EDUINNOVA project. It comprises a series of learning activities that involves assigning children in a class randomly to groups of three who then work together to solve a series of challenges on their individual PDA. The challenges are created or edited by the class teacher as appropriate for that day's lesson. The nature of the Eduinnova activity design means that each group member must play a part and the software allows the teacher to have oversight in real time of each group of students' progress. Whyley et al (2006) reports that teachers have been particularly impressed by the degree of cooperation that results, even between children who normally find it very challenging to work together. Children who would not normally speak to one another quickly settled to work.

Context: Situating Learning

One of the most exciting aspects of PDA use in schools for a science teacher is how having a handheld with camera and location awareness (via GPS) can enable both context relevant learning outside the classroom and bringing data and images taken from the outside world into the school to situate learning in a context known to the pupils. However, situated learning theory as originally described by Lave and Wenger (1991) involves social interaction and collaboration as well as an authentic context and is usually unintentional. In the following examples of PDAs being used to enhance and support fieldwork the learning is clearly intentional. The PDA activities involving images and background information are motivating and strengthen the link between concepts learned and context where they are found.

Fieldwork in science and geography, using mobile devices to bring context related information into the classroom, was one of the first successes for mlearning within formal education. Soloway (1999) describes several early examples from schools in the United States using Palm handhelds and probeware in the field. In the UK the Booted up Bristol project (Squire, 2005) is now working with nearly 300 schoolchildren a year to investigate a local river and nearby woods using PDAs and MP3 players as well as more traditional kit such as a compass and nets. Each school is provided with a CD of all their data, images and sounds and a curriculum pack of ideas and useful website links to continue their learning back at school. One headteacher reported that "This was the best piece of geography fieldwork he'd done in 17 years of teaching".

Further innovation involves adding GPS functionality to add location specific information which enables students, even young pupils to report useful data for national surveys such as those carried out on carbon monoxide levels and noise pollution by the Participate project in Bath, UK (Oldroyd, 2006). In the first phase of this project students from secondary schools in Bath combined their data with the Google Earth software to produce a stunning visualisation of pollution levels over the city. Trials on a fieldtrip to Wales for the Wolverhampton PDA project (Whyley et al, 2006) showed that Year 6 learners using a Bluetooth GPS unit and Memory Map software were able to track themselves on their Ordnance Survey map walk and embed photos, videos and word files of their experience to create a multimedia real time field trip log.

Discussions and Conslusions

In their extensive review of pedagogical theory for mlearning created as part of the international Mobilearn project O'Malley et al (2005), suggest that theories of learning must be tested against the following criteria

- Do they account for both formal and informal learning?
- Do they analyse the dynamic context of learning?
- Do they theorise learning as a constructive and social activity?

The combination of a constructivist approach encouraging learner control of interactive learning 'conversations' with a handheld device, with software engendering challenge and curiosity set within a pertinent context and allowing for collaborative learning is extremely powerful. It creates confident learners and clearly fulfils O'Malley et al's (ibid) proposed criteria.

Though I earlier separated the theories in order to describe them – this is not in fact the case. These cognitive aspects of learning are interdependent and combined in a complex web creating motivation and understanding. Byrnes (1996) noted the way in which students can become intrinsically motivated when they have control over their environment, set challenges for themselves and satisfy their curiosities. Lepper et al (1993) first applied this combination to computer based learning in their proposal that an expert tutoring system should maintain the learner's sense of personal control, enhance confidence, produce an appropriate level of challenge and elicit a high level of curiosity. Sharples (2003) adds that the interaction between learner control and success is complex. Successful self-management of learning comes as a result of developing competence and skill in learning how to learn, ie how to form connections and construct mental schemas. Specifically with mobile technologies learning can also be seen to be effective when control is appropriately distributed among the learners through collaborative working within a shared environment.

Ravenscroft (2000) points out that successful conversational learning itself comes when the learner is in control of the activity, able to perform experiments, ask questions, and engage in collaborative argumentation. Sharples (2003) adds that the mobile learning device assists conversational learning by integrating context, for example by making connections between exhibits in a museum, and by supporting constructivism through holding the results of learning actions for later retrieval and reflection. He considers that in reviewing learning through mobile technologies, we may well come to conceive of education as conversation in context, enabled by continual interaction through and with the personal, mobile device (Sharples, 2005).

Thus the power of learning seen in the examples above of students using mobile devices appears to be a human response to the way in which this new learning technology enables each and every aspect of that complex web of interlinked cognitive concepts to resonate together during episodes of learning.

The current challenge is to untangle this complex web in order to provide clear direction for teachers, lectures, software and hardware designers for future development of mobile devices and learning and teaching activities. O' Malley et al (2005) suggest extended activity theory (Engeström, 1987) as a way of usefully describing theoretical approaches to mlearning and have indeed used it to create a number of helpful pedagogical guidelines for setting up learning activities with mobile devices. However, whilst enabling a descriptive framework, activity theory does not help us understand the entwined, interconnected, involving cognitive web described in this paper. We need to look to further research – perhaps within the field of cognitive developmental psychology applied in educational contexts to help.

However, for the moment, it is enough that software and hardware manufacturers and educational developers pay attention to these key concepts that so clearly underpin the success of mlearning.

References

Bailey, N., (2006). Wildkey, Using Handhelds to Identify and Record Wildlife. Paper presented at *Handheld Learning 2006*, Oct 12-13 2006, London, UK.

Bruner J., (1966). *Toward a Theory of Instruction*. Norton, New York.

Byrnes, J. P., (1996). *Cognitive Development and Learning in Instructional Contexts*. Allyn and Bacon.

Davis N., Desforges, C., Jessel, J., Somekh, B., Taylor, C. and Vaughan, G., (1997). Can quality in learning be enhanced through the use of IT in Somekh, B. and Davis, N. (ed) *Using Information Technology Effectively in Teaching and Learning*. Routledge.

Engeström, Y., (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.

Jones, A.C., (2006). Affective factors in learning with mobile devices in Sharples, M. (ed) *Big Issues in Mobile Learning: Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative*. Accessed from http://www.nottingham.ac.uk/lsri/msh/Reports/Big%20Issues%20in%20mobile%20learning%20report.pdf [5/12/06]

Lave, J. and Wenger, E., (1991). *Situated Learning. Legitimate peripheral participation*. Cambridge: University of Cambridge Press.

Lepper, M.R., Woolverton, M., Mumme, D.L. and Gurtner, J-L., (1993). Motivational techniques of Expert Human Tutors: Lessons for the Design of Computer-based Tutors in Lajoie, S.P. and Derry, S.J. (eds) *Computers as Cognitive Tools*. Hillsdale: Lawrence Erlbaum Associates.

Malone, T.W., (1981). What makes computer games fun? *Byte*, Dec 1981, 258-277.

NCET/NAACE, (1994). *Inspecting IT*. Coventry: NCET

Oldroyd, A., (2006). Participate in the digital revolution. BT e-zine. Accessed from http://www.btplc.com/Innovation/mobility/revolution/revolution.pdf [5/12/06]

O'Malley et al, (2005). Pedagogical methodologies and paradigms: Guidelines for learning/ teaching/ tutoring in a mobile environment. *MOBIlearn Report UoN,UoB,OU/WP4/1.2*. Accessed from http://www.mobilearn.org/download/results/public_deliverables/MOBIlearn_D4.1_Final.pdf [5/12/06]

Papert, S., (1980). *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books.

Pask, A. G. S. (1976). *Conversation Theory: Applications in Education and Epistemology*. Amsterdam and New York: Elsevier.

Pea, R.D. (2002). Learning Science through Collaborative Visualization over the Internet. *Nobel Foundation Virtual Museums Symposium*. Stockholm, May 26-29.

Pea, R. D. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (ed). *Distributed cognitions*. New York: Cambridge University Press, pp. 47-87.

Perkins, D. N. (1993). Person-plus: A distributed view of thinking and learning. In G. Salomon (ed). *Distributed cognitions*. New York: Cambridge University Press, pp. 88-110.

Piaget, J., (1950). *The Psychology of Intelligence*. New York: Routledge.

Ramsden, A. (2005). Evaluating a PDA for Delivering VLE Functionality in Kukulska-Hulme, A. and Traxler, J. *Mobile Learning: A Handbook for Educators and Trainers*. London: Routledge

Ravenscroft, A., (2000). Designing argumentation for conceptual development, *Computers and Education*, vol. 34, pp. 241-255.

Sharples, M., (2003). Disruptive devices: mobile technology for conversational learning. *International Journal of Continuing Engineering Education and Life Long Learning*, 12(5/6), 504-520. Accessed from http://www.nottingham.ac.uk/lsri/msh/Papers/ijceell.pdf [5/12/06]

Sharples, M., (2005). Learning As Conversation: Transforming Education in the Mobile Age. In *Proceedings of Conference on Seeing, Understanding, Learning in the Mobile Age*, pp. 147-152. Budapest, Hungary.

Soloway, E., (1999). *Science in the palms of your hands Communications of the ACM* 42(8),21-27

Squire. S., (2005). Excel in Fieldwork: the Booted Up Bristol project. Paper presented at the *The 8th South West of England Schools ICT Conference: Embedding ICT*. July 5th 2006. Bristol, UK

Treadwell, I., (2005). Using Portable Technology for Assessment of Practical Performance. Paper presented at *Mlearn'05*, Cape Town. Accessed from http://www.mlearn.org.za/CD/papers/Treadwell%20removed.pdf [5/12/06]

Trinder, J., (2006). *Possible Uses of PDAs for Engineering Students with Disabilities*. Higher Education Academy – Engineering Subject Centre. Accessed from http://www.engsc.ac.uk/er/dis/pda.asp [5/12/06]

Underwood, J. (ed), (1994). *Computer based learning. Potential into Practice*, David Fulton.

Whyley, D. et al, (2006). *Learning2Go*. Accessed from http://www.learning2go.org/ [5/12/06]

Wishart, J.M. Ramsden, A. and McFarlane, A.E., in press. PDAs and Handhelds: ICT at your side and not in your face. *Technology, Pedagogy and Education*.

Wishart, J., (1990). Cognitive factors related to user involvement with computers and their effects upon learning from an educational computer game, *Computers and Education*, Vol 15 (1 3), 145 150.

UBIQUITOUS LEARNING OR LEARN HOW TO LEARN AND YOU'LL NEVER HAVE TO LEARN ANYTHING AGAIN?

Russell Beale
Advanced Interaction Group, School of Computer Science
University of Birmimgham
R.Beale@cs.bham.ac.uk

Abstract

First came teachers: Plato spoke, asking questions – as did Socrates (giving rise to the Socratic method). People gathered, discussed, thought, reasoned, and were enlightened. Then came books. People read, thought, reasoned, and were educated. We then had teachers: talking, and using books, to instil knowledge in students, who listened, and read, and discussed, and wrote, and became educated. Then came e-teaching: like teaching, only on computers. People found it slightly harder to get to grips with, were sometimes educated, often frustrated, and were occasionally educated. The came e-learning: structured, personalised education based on personal abilities and interests. People were a little put off by their e-teaching experiences, but gave it a go, and it worked reasonably well for some of them – though the complexity of systems, the frustrations of computers, were still there. Then came m-learning – learning on mobile devices – and when people worked out that presenting large quantities of material on a small screen was sub-optimal, and that there were better things to do with mobile devices than focus on their least effective features, like their display or memory, we gained context- and location-sensitive systems, which provided relevant content tailored to individuals, and provided a rich and rewarding educational experience – at least in the laboratory.

But with all these systems, different forms of learning were supported in different ways, and students adopted different learning styles and approaches to maximise their benefits from the technologies. Educators realise this, and propose that blended approaches to learning are used, since different topics, styles and learners benefit differently from the alternative approaches. For best effect, history has shown us that new technologies do not tend to best support existing practices; instead, they open up new opportunities for alternative learning that suits the medium more. Books widened participation; e-teaching tried to present books and schoolroom teaching on a computer, and failed, whereas proper e-learning utilised the multimedia capabilities of the system, and related it to models of user knowledge acquisition and self-testing and presented tailored programmes that suited users. Mobile learning has come into its own now that it better understands the nature of mobility (devices *and* users) and plays to the strengths of context, location, and immediate presentation of relevant and interesting information.

So the interesting question is, where will we go next? What form of learning should we be considering for the next step beyond mobile learning?

From both a technological and a social perspective, the next step beyond mobility is ubiquity: a vision of the world in which multitudinous devices are embedded in the everyday world, around our persons, and in the devices we carry. These systems communicate with each other and with us, connecting us every closer to a digital web in which information, the environment, other participants and ourselves are closely interwoven. If we try to present educational approaches that we currently use into this new mesh of interpersonal, interwoven information spaces, we are doomed to fail. Interaction in this new world is different – it is mediated as if by magic by multitudinous systems, many of which we have little or no comprehension of, and it is these differences in interaction that occurred at each of the historical shifts in approaches to education and learning.

Current educational dilemmas present us with an insight into these issues. Questions have become less meaningful in today's educational landscape: Google can answer a question, with no knowledge acquired by the student. Essays can be produced from essay banks, with the student participating in the learning process not one iota. However, knowing how to use information tools has become critical. In the ubiquitous future, it is quite likely that information is an easily accessible resource – if you know how to get to it. Facts become merely items to be accessed, rather than knowledge to be acquired. Knowing how to find out information, how to manipulate it, how to condense it; these will become key skills. Verifying information is reputable, understanding its veracity, assessing quality and reliability, combining and presenting it with conciseness and precision: these will be the key skills that separate the good from the bad, the innovative from the plodders.

If you know how to access information, what information to trust, and how to combine and present it, then actually knowing anything will become irrelevant: details can be provided by the back end systems, by the environment. Deciding how best to access and fuse the different, conflicting and potentially overwhelming quantity of data will be a distinguishing feature of the new learning agenda.

Finding new ways of seeing things, being creative, providing new perspectives on the world and our place in will become more important.

Though maybe it was always thus?

Keywords
Ubiquitous systems, creativity, new educational goals

References
1. Beale, R. *Designing architectures to support mobile learning*. in *International Conference on Computers in Education*. 2004. Melbourne, Australia.
2. Beale, R. *Mobile blogging: experiences of technologically led design*. in *CHI Experience Reports*. 2006. Montreal: ACM.
3. Beale, R. and P. Lonsdale, *Mobile Context Aware Systems: The Intelligence to Support Tasks and Effectively Utilise Resources*. 3160 ed. Lecture Notes in Computer Science. 2004. 240-251.
4. Lonsdale, P., et al., *Context awareness for MOBIlearn: creating an engaging learning experience in an art museum*, in *MLEARN 2004*. 2004, LSDA: Bracciano, Rome
5. Lonsdale, P., et al., *Spatial and context awareness for mobile learning in a museum*, in *KAL CSCL Workshop on "Spatial Awareness and Collaboration"*. 2004
6. Beale, R., A. Dix, and R.J. Hendley. *Concept formation through evolution*. in *Strategic Knowledge and Concept Formation*. 1997.
7. Beale, R., A. Pryke, and R.J. Hendley. *Evolutionary approaches to visualisation and knowledge discovery*. in *Computer Human Interaction*. 2004. Rotorua, New Zealand: Springer-Verlag.
8. Pryke, A. and R. Beale, *Interactive Comprehensible Data Mining*, in *Lecture Notes in Computer Science, LNCS/LNAI 3345*, Y. Cai, Editor. 2005: Springer-Verlag. p. 48-65.
9. Pryke, A. and R. Beale, *Ambient Intelligence for Serendipitous Science*, in *ACM CHI Workshop on Ambient Intelligence*. 2004, ACM: Vienna. p. 4 pages
10. Beale, R., *Contextual information presentation for optimal learning: initial study*, in *European Workshop on Mobile and Contextual Learning*, S. Anastopoulou, M. Sharples, and G.N. Vavoula, Editors. 2002, The University of Birmingham, UK: Birmingham, UK. p. 66
11. Beale, R., *Seeing the right thing at the right time: a case study of information presentation in stressful environments*. New Zealand Journal of Sports Medicine, 2005: p. 10 pages (accepted 2004, to appear).
12. Beale, R., *Improving Internet Interaction: from theory to practice*. Journal of the American Society for Information Science and Technology. Special Issue, Best Practices and Future Visions for Search User Interfaces, 2005: p. 14 pages (accepted 2004, to appear).
13. Beale, R., *Presenting appropriate information: a case study.*, in *Human Performance in Sailing*, S.J. Legg, H.W. Mackie, and D. Cochrane, Editors. 2003: UniTech, Auckland, New Zealand
14. Beale, R., *Highly intelligent, well-connected, and mobile - the perfect assistant?*, in *Media-tech 2003*. 2003: (online conference). p. 8
15. Beale, R. *Mobiles for Social Interaction*. in *Convivo workshop (unpublished)*. 2005. Munich.
16. Beale, R., P. Lonsdale, and M. Sharples, *Models for mobile context awareness*, in *AISB Quarterly*. 2004
17. Syvanen, A., et al. *Supporting Pervasive Learning Environments: Adaptability and Context Awareness in Mobile Learning (poster)*. in *IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE 2005)*. 2005. Tokushima, Japan: IEEE.
18. Beale, R., R.J. McNab, and I.H. Witten. *Visualising sequences of queries: a new tool for information retrieval*. in *IEEE Conf on Information Visualisation*. 1997. London, England: IEEE.
19. Dix, A., R. Beale, and A. Wood. *Architectures to make Simple Visualisations using Simple Systems*. in *Proceedings of Advanced Visual Interfaces (AVI)*. 2000: ACM Press.
20. Hendley, R.J., et al., *Narcissus: visualising information.*, in *Readings in information visualization: using vision to think.*, S. Card, J. Mackinlay, and B. Schneiderman, Editors. 1999, Morgan Kaufmann Publishers Inc. p. 503-511.

SMART – AN APPLICATION TO SUPPORT ANIMATION ON MOBILE DEVICES

Peter Byrne
Trinity College Dublin
Dublin 2, Ireland
Peter.A.Byrne@cs.tcd.ie

Brendan Tangney
School of Computer Science & Statistics
Trinity College Dublin
tangney@tcd.ie

Abstract

Digital video is increasingly being used as a technology to facilitate learning experiences both within the classroom and without, e.g.(Buckingham, D. et al. 1999). (Posner, I. et al. 1997) conclude that "children can quickly become digital movie authors", while (Kearney, M. and Schuck, S. 2005) argue that Digital video projects encourage development of media literacy, communication and presentations skills. (Crotty, C. et al. 2005) describes how, inspired by the work of (Jonassen, D.H. 2000), digital film technology can be used "as a Mindtool to engage students in complex, creative and critical thinking" and encourages creativity and self-expression (Reid, M. et al. 2002).

The process of film making is also time consuming and typically involves projects spanning over hours or days and requires collaboration between groups of four to five or more. Animation shares many of the potential educational advantages of digital film making while at the same time being a much simpler, and less expensive, process in which to engage. Traditional "Stop Motion Animation" involves shooting a movie one frame at a time, changing drawings of characters slightly between each, thereby creating the impression of movement. Clay animation is a variation on this technique using real or clay objects.

(Hämäläinen, P. et al. 2004) claim that clay animation has the advantage of being "concrete and easy to approach for the beginner" while supporting development of additional skills including "hand-eye coordination, sculpture, and animation". (Tatar, D. et al. 2003) describe a project to use Sketchy™ to animate scientific processes, describing how designing animations to represent such processes promotes understanding of science and state that by "beaming their sketches to one another and the teacher, and discussing what is represented, students discover what is important to illustrate".

The argument has been made that every student will have a portable wireless device (Bull, G. et al. 2002) and that "ubiquitous computing will be a widespread force in schools by the end of the decade or sooner" (Bull, G. et al. 2002). The functional-pedagogical framework for mobile learning proposed by (Patten, B. et al. 2005) supports that unique attributes of handheld devices such as data collection, location aware and connectivity, support collaborative, contextual and constructionist learning experiences, which would not be possible without mobile technology.

This paper describes smart an application designed to support a collaborative, contextual, constructionist and constructivist approach to creating animations. The application supports individuals, or groups, creating animations, collaborating in a face-to-face manner. The application runs on a mobile phone with a view to exploiting the ready-at-hand nature of such devices. The application is implemented using Java and J2ME. The Sony-Ericsson K750 mobile phone has been used for development and testing. The principle limitation of the system is the lack of processing power on mobile phones, which currently necessitates a server computer to provide some functionality i.e. rendering.

An out of school "computer clubhouse" activity run within our university is the principle environment for the users studies described in this paper.

Keywords

Handheld computing, Animation, Constructionism, Collaboration, Mobile Phones

References

Buckingham, D., et al. (1999). The difference is digital: digital technology and student media production. Convergence: *The Journal of Research into New Media Technologies*, 5, 10-21.

Bull, G., et al. (2002). Grand Challenges: Preparing for the Technological Tipping Point. *Learning & Leading with Technology*, 29.

Crotty, C., et al. (2005). Power to the Students: Filmmaking Activity as a Mindtool in Education FAME. *International Conference on Multimedia, Image Processing and Computer Vision*. International Association for the Development of Advances in Technology ed. Madrid.

Hämäläinen, P., et al. (2004). Animaatiokone: an Installation for Creating Clay Animation. *CHI 2004*. Vienna, Austria.

Jonassen, D.H. (2000). *Computers as Mindtools in Schools: Engaging Critical Thinking*, New Jersey, Prentice-Hall.

Kearney, M. and Schuck, S. (2005) Students in the Director's Seat: Teaching and Learning with Student-generated Video. in Kommers, P. and Richards, G. (eds). *World Conference on Educational Multimedia, Hypermedia and Telecommunications 2005*. Montreal, Canada, AACE.

Patten, B., et al. (2005). Designing collaborative, constructionist and contextual applications for handheld devices. *Computers and Education*, August 2005, pp 1-14.

Posner, I., et al. (1997). Children Learning Filmmaking Using Multimedia Tools. *Proceedings of ED-MEDIA/ED-TELECOM 1997*. Calgary, Canada.

Reid, M., et al. (2002). *Evaluation Report of the Becta Digital Video Pilot Project*. Coventry: Becta.

Tatar, D., et al. (2003). *Handhelds Go to School:Lessons Learned. SRI International*, pp 30-37.

HOW PEOPLE COLLABORATE TO LEARN IN DIFFERENT CONTEXTS SCAFFOLDED BY THE MOBILE TOOLS

Sanna Järvelä
University of Oulu
Educational Technology Research Unit
Department of Educational Sciences
and Teacher Education
P.O.BOX 2000,
FIN-90014 University of Oulu
Sanna.jarvela@oulu.fi

Jari Laru
University of Oulu
Educational Technology Research Unit
Department of Educational Sciences
and Teacher Education
P.O.BOX 2000,
FIN-90014 University of Oulu
Jari.laru@oulu.fi

Piia Näykki
University of Oulu
Educational Technology Research Unit
Department of Educational Sciences
and Teacher Education
P.O.BOX 2000,
FIN-90014 University of Oulu
Piia. naykki@oulu.fi

Abstract

Successful collaboration and creation of opportunities for multiple social interactions are critically important to the future of teaching and learning. People need to learn more and faster – in formal educational settings and in informal learning environments - and to collaborate more often in order to solve problems and construct, share, and create new information. Because individual cognition, motivation and interactions cannot be isolated from the social and cultural contexts in which they occur (Pintrich, 2000), we as educational researchers and designers need to know more about those processes when people collaborate to learn in a variety of contexts. Individual and socially shared self-regulation plays a role in the effectiveness, efficiency, and even in enjoyment of collaboration. In our previous research we have analyzed collaborative interactions as a means of gaining insight into the processes of collaborative learning and attempt to clarify what constitutes productive collaborative activity (Järvelä & Häkkinen, 2004). In this research, it has also become evident that successful collaboration is not a spontaneous phenomenon, but structuring and regulating socially shared learning process is needed (Järvelä, Järvenoja & Volet, 2006).

The objective of our research has been to contribute to knowledge of effective learning processes by exploring how ambient, particularly context-aware technologies for mobile use could support collaborative learning by offering new opportunities for social interaction and creating scenarios for their design, development and implementation (e.g. Roschelle, Rosas & Nussbaum, 2006). The work is grounded in recent theoretical and conceptual understanding of collaborative learning as cognitive, social, and motivated activity (Boekaert, Pintrich & Zeitner, 2000).

In this position paper our two design experiments on mobile, handheld supported collaborative learning are presented to demonstrate our research. Both experiments are aimed at investigating novel uses to support collaborative learning with smartphones. In the first study (Laru & Järvelä, 2006) smartphones with self-organizing bluetooth networking were used as a collaborative tool in dyads of students (n=22) to scaffold inquiry learning in nature park. The results indicate that peer-to-peer enabled smartphones can act as one scaffold of distributed scaffolds to support collaborative inquiry learning. Students' use of smartphones resulted sharing and storing their arguments of nature inquiry for immediate and latter use. In the second (Näykki & Järvelä, 2006) study smartphones without networking were used as regulation tools to externalize knowledge representations in an individual and collaborative levels. University students (n=13) used smartphones in groups of 2-4 students to collect pictures and make annotations about a given topic. The content collected with mobile phones was then developed further by constructing a mind map of collected pictures and text by using desktop computers.

Keywords

Collaborative Learning, Self-Regulation, Mobile Tools, Smartphones, Knowledge Construction

References

Boekarts, M., Pintrich, P. R. & Zeidner, M. (Eds.) (2000). *Handbook of self-regulation*. San Diego, CA: Academic Press.

Järvelä, S. & Häkkinen, P. (2005). How to make collaborative learning more successful with innovative technology? *Educational Technology Magazine*, 5, 34-39.

Järvelä, S., Järvenoja, H. & Volet, S. (2006). *Motivation in collaborative learning: new concepts and methods for studying social processes of motivation.* Submitted.

Laru, J. & Järvelä, S. (2006). *Distributing scaffolds between peers, teachers and mobile technologies – Design experiment for collaborative inquiry learning in the nature.* Submitted.

Näykki, P. & Järvelä, S. (2006). Shared Visual Representations in Collaborative Knowledge Construction. In G. Clarebout & J. Elen (eds.), *Avoiding simplicity, confronting complexity: Advances in studying and designing powerful (computer-based) learning environments*, pp. 393-403. Rotterdam: Sense Publishers.

Pintrich, P.R. (2000). Educational Psychology at the Millennium: A look back and a look forward. *Educational Psychologist, 35*, 221-226.

Roschelle, J., Rosas, R., & Nussbaum, M. (2006). Towards a design framework for mobile computer-supported collaborative learning. In *Proceedings of the 2005 conference on Computer support for collaborative learning: learning 2005: the next 10 years!* Taipei, Taiwan, 2005. Pp.520 - 524

BEYOND MOBILE LEARNING

Josie Taylor
The Open University
Milton Keynes, UK MK7 6AA
j.taylor@open.ac.uk

Abstract

How quickly is the digital world changing? How many of us perceive that change? For whom is it important? Who cares? The so-called 'digital divide' can be characterised nowadays as being between those who are able to keep up to date with changes in the digital landscape, and find time to participate in it, and those who perpetually find themselves embarrassed to have to admit that they don't have an avatar in a 3-D virtual environment, don't have a in-car navigation system, don't play any on-line games, have no blog, and can't understand wikis. (Why these should be perceived as embarrassing admissions is a moot question.) My first interest lies in understanding how people appropriate technologies, and why. My second interest is in seeing how people's view of the real world shifts as they move more towards a pervasive computing future.

We all live in a digital landscape, but many of us remain either blithely unaware of what is out there, or choose to engage with only some of the available opportunities. Whilst most people now have at least heard of the Web (even my mother) I am acutely aware that when moving around my social environment, I have now to modify my expectations more explicitly than ever before about the kinds of personal technologies people will be familiar with. My family back home in Worcestershire will not share the same pool of devices/functionalities that my university colleagues do. My children may share the same basic suite of devices as me, but probably have wildly variant functionalities delivering information and services to their attention, and whole sets of behaviours that I can't even recognise.

My question is: does it matter? Are we just passing through a phase of 'device bloat' that will pass, or are fundamental changes occurring in the space we inhabit? Is the pervasive, ambient, ubiquitous environment a digital myth or a lived reality?

DESIGN PATTERNS FOR MOBILE LEARNING

Niall Winters
London Knowledge Lab

Abstract

Designing mobile learning experiences is a complex task, requiring the assimilation and integration of deep knowledge from educators, researchers, practitioners, designers and software developers. While each party may have expertise in several of the associated knowledge domains, no single party has expertise in all of them. The complexity of each of the various bodies of knowledge means that it is often hard to communicate ideas, with each community having developed its own lore and jargon. We promote the use of design patterns to address this problem and argue that design patterns hold a powerful promise for recording, calibrating and collaboratively refining expert knowledge.

In general, a design pattern is defined as a high-level specification for a method of solving a problem by design. Its particular strength is in highlighting recurring techniques and solutions to design problems that are found again and again in real—world mobile application development. Design patterns enable this process of knowledge discovery by specifying the particulars of a problem, and how the designated design instruments can address them.

Patterns are flexible enough to address a very broad spectrum of practice, from in-depth technical development to deployment issues in classrooms and elsewhere. In this talk, we explicitly focus on how to construct design patterns by reflecting on our experiences, emphasising the interdependent relationship between design and deployment for mobile learning. Initial results indicate that while patterns capture solutions to generalisable problems, learning to think about practices in an abstracted way, in order to development patterns, requires significant scaffolding.

BIOGRAPHIES

INMACULADA ARNEDILLO-SÁNCHEZ is a lecturer in Learning Technologies in Trinity College Dublin and a researcher in the Centre for Research in IT in Education (CRITE - www.cs.tcd.ie/crite) a joint initiative between Trinity's schools of Education and Computer Science & Statistics. She is the programme chair for the 2007 IADIS Mobile Learning Conference and a member of the learning and technology programme committee for the 2007 5th World Summit for Children and Media. Ms. Arnedillo's research interests focus on mobile learning and in particular in the use of mobile technologies for creativity and collaboration. Her research on the design of learning technologies and applications is strongly anchored in learning principles. TRUST-E (Teaching and Research in a Ubiquitous Secure Telecommunications Environment) and the Computer Clubhouse, an informal learning environment in which technology-enhanced learning experiences are implemented, are two of the research projects that Ms. Arnedillo is currently leading.

RUSSELL BEALE has been involved in research into user-centred systems for almost twenty years and focuses on using AI approaches coupled with highly usable design. He has worked on mobile learning systems [1-5], user-centred knowledge discovery [6-9], and on optimum information presentation in complex situations [10-13]. He has been involved in the design and build of intelligent architectures to support information access for both mobile learning [1, 14-17] and visualisation [18-20]. His current interests are in how users can interact with complex information; the role of affect and personality in interaction; ubiquitous, pervasive and mobile computing; and how technology impacts and affects our social structures and activities.

He has founded four high-technology companies and has spent time in both small and large commercial organisations, but enjoys the freedom and challenges that being an academic allows him.

PETER BYRNE has a B.A. (Mod) in Information and Communications Technology (1998-2002) and an M.Sc in Networks and Distributed Systems (2003-2004) from Dublin University, Trinity College. Has worked as a research assistant in the Machine Learning Group at Trinity College investigating an application Case Based Reasoning to physiotherapy treatment. Is currently doing a PhD in the use of mobile technology in education, in the Center for Research in IT in Education, (CRITE) at Trinity College.

After a year in the department of Physics, **MAURO CHERUBINI** obtained a degree in Educational Studies from the third University of Rome (RomaTre) in 2001, with a thesis on the Usability of the Children's Internet Sites. Then he worked as a research assistant at the new Media Lab Europe in Ireland, spending several periods at the MIT Media Lab in Boston. He finally obtained a Master of Arts by Research from St. Patrick's College, Dublin City University in 2004, with a thesis on Microworlds for Ecology Explorations.

In 2004 he joined the CRAFT team for his PhD on collaborative annotations of Maps. He is interested in how to use location awareness to enhance and economise the inference process of people during a communication/ problem solving/learning activity.

GIULIANA DETTORI completed her studies in Mathematics at the University of Genoa (Italy) in 1978. Since then, she has been working as researcher for the National Research Council of Italy, first at the Institute for Applied Mathematics, then, from 2002, at the Institute for Educational Technology, both in Genoa, Italy.

Her research interests have covered different topics in Applied Mathematics and Educational Technology. She has authored numerous scientific papers, at national and international level, in Education, Computer Graphics and GIS and has been involved in several national and international projects.

During her professional career, she spent about two years in the USA, where she was visiting scientist at Syracuse University (NY), and five months in Ecuador where she was teaching at a local University.

Her current research interests concern the mediating role of ICT in teaching and learning. In particular, she is actively working on narrative learning environments, self-regulated learning and online learning.

MONICA DIVITINI is Professor of Cooperation Technology at the Department of Information and Computer Science, Norwegian University of Science and Technology. She holds a MSc. in Information Science from the University of Milano, Italy, and a PhD in Computer Science from the University of Aalborg, Denmark. She is currently project leader for the MOTUS2 project on the usage of mobile technologies in university education and of FABULA, a project on the usage of wireless technologies for transforming the city into a learning arena. Her research interests lie primarily in the area of CSCW, collaboration technologies for loosely coupled groups, mobile collaborative technology in education, cooperative technologies for children.

BO FIBIGER has worked with ICT and learning in the last 30 years – from the first mature applications in the 1980s to the multimedia-based online communication of today. He has been editor of national and international readers in the area, and he has published several international articles. His background is communication studies especially related to audiovisual media. He has been head of the research programme on Video and it (VENUS) in the beginning of the 1990s, been member of the national research group on ICT and learning from 1994-1998, member of a national research project on Distributed multimedia from 1998-2002. From 2001 – 2004 he was the leader of a work package on video in education in the development project Flexnet (at the IT University West) and from 2004 partner in a national project on use of video in education, funded from the Danish Research Network (Forskningsnettet). At present, he is involved in projects related to the use of video in education: 1) streaming video and integration of video, 2) video and tacit knowledge, as well as 3) mobile units in education.

- Member of the steering committee for a national master degree on ICT and learning.
- Jury member for a Danish price for best practise in the use of video for education ("The golden cut").
- Member of kaleidoscope.
- Member of the advisory board of a newly established national eKnowledge Centre.

LYNDSAY GRANT is a learning researcher at Futurelab, developing and researching the use of digital technologies for learning. She has recently worked on the potential of new social web technologies and mobile learning approaches to support innovative teaching and learning practices. Working in partnership with industry, policy and practice, Futurelab develops new ideas, creating and trialling prototypes to inform the design and use of innovative learning tools. Lyndsay joined Futurelab in the summer of 2005, prior to which she was an educational publisher, commissioning print and digital resources for use in schools.
www.futurelab.org.uk

KIM ISSROFF is a senior lecturer at the Centre for Research in Education and Educational Technology at the Open University and co-director of the Computers and Learning Research Group. Her research interests centre on computer-supported collaborative learning and the ways in which affective factors impact on our learning and use of technologies in a range of educational settings.

SANNA JÄRVELÄ is a professor in the field of learning educational technology and a head of the Educational Technology Research Unit in the Department of Educational Sciences, University of Oulu. Her main research interests deal with learning processes in technology-based and virtual learning environments, social and motivational processes in learning, self-regulated and computer supported collaborative learning and mobile learning. Järvelä's research group (http://www.edtech.oulu.fi/) is part of the European Network of Excellence "Kaleidoscope". Recently the group has been active in multidisciplinary mobile learning research work and especially developed scenarios and experiments for using wireless technology and pervasive technologies for distributed collaboration. Järvelä has been an invited expert in different national (e.g. Ministry of Education) and international expert commissions (e.g. OECD and scientific organizations). During the year 2000-2001 she was visiting scholar in Kings' College London, UK. Järvelä has published more than 50 scientific papers in international refereed journals and several book chapters and two edited books.

ANN JONES is a senior lecturer at the Institute of Educational Technology at the Open University and co-director of the Computers and Learning Research Group with research interests in learning and learning theories, and the application and evaluation of educational technologies in education.

MR. JARI LARU (M.Ed.) works as a researcher in a Research Unit for Educational Technology and has been accepted to the affiliate position to the Graduate School for for Multidisciplinary Research on Learning Environments. His research work is focused to explore how to scaffold collaborative learning with cognitive tools based on ubiquitous and pervasive technologies.

ROSSELLA MAGLI graduated in Law from the University of Bologna, got a Masters in International Relations from Johns Hopkins University – School of Advance International Studies and a DEA in Communication, Technologies and Power from Sorbonne University (France). In 1997-1998 she was Invited Scholar at the Graduate School of Education of the University of Pennsylvania, Philadelphia.

Since 1987, she has developed a considerable professional experience in the framework of international research projects with a specific focus on the qualitative evaluation of the social impact and uses of information and communication technologies in educational settings, both formal and informal, on the innovation of educational systems, on the creation of communities of practices in education, on technologies and space architectures, on informal learning and museums. She has also been invited as expert in the negotiation of educational policies in working groups of researchers or policy-makers at the European level (consultations on future EU policy initiatives on education and technologies). She is also member of the Core Group of the Network of Excellence on Technology Enhanced Learning, as well as partner in several network activities, namely on new educational formats, and technology-enhanced spaces for intergenerational learning.

In 2006, she published a book on an ethnographic study on the use of Internet and e-mails in primary school: Barchechath, E., Magli R., Winkin, Y. (2006) *Comment l'informatique vient aux enfants: Pour une approche anthropologique des usages de l'ordinateur à l'école"*. Editions des Archives Contemporaines, Paris.

DR DAISY MWANZA-SIMWAMI is an Academic Research Fellow in Distributed and Mobile Learning at The Open University's Institute of Educational Technology (IET) http://iet.open.ac.uk/pp/d.mwanza/. Daisy's academic background is in the subject area of Human Computer Interactions although much of her current work comes under the field of Educational Technology. Her research interests are centered on methods for informing systems design, particularly e-Learning Technology, CSCL and CSCW systems. Daisy's approach to systems design is shaped by activity oriented methods that are influenced by both theory and her background in HCI perspective. Daisy is known for her work on methods for applying activity theory to system design which draws from an HCI point of view. Daisy has used this approach in two major EU funded projects namely Mobilearn and Lab@Future. Prior to joining IET, Daisy did her PhD in Human Computer Interactions at the Open University's Knowledge Media Institute jointly supervised by IET. This was followed by employment as a Research Fellow in IET on the Mobilearn project. After this, Daisy worked as a Visiting Research Fellow at the University of Helsinki's Centre for Activity Theory and Developmental Work Research (AT&DWR)in Finland between 2003 and 2005, working on the Lab@Future project. Daisy rejoined the Open University last May 2005 to take up her current role in which she works closely with colleagues in two of IET's local research groups: CALRG http://creet.open.ac.uk/calrg.cfm and TLRG http://creet.open.ac.uk/tlrg.cfm on various research and academic related projects.

ELI M. MORKEN holds a Master of Science from the Norwegian University of Science and Technology. She is currently working on her PhD with a grant by NTNU's programme for ICT and Learning. Her research is focused on lightweight cooperative technologies to support practice based teacher education.

EILEEN SCANLON is Professor of Educational Technology amd co Director of the Centre for Research in Education and Educational Technology at the Open University. Her research interests include collaborative learning, science education and technology enhanced learning.

(PEGGY) SHAO is a Phd student in Learning Sciences and Research Institute at the University of Nottingham. Previous experiences are frontline practices and researches on ICT application in School, Work-based e-learning design in China. Besides, she did research on foreign language learning with i-mode cell phone when she was a Master student in University of Twente, the Netherlands. Her current interest involves Mobile learning in higher education, ICT in fundamental education, Ubiquitous Computing and Collaborative Learning.

MIKE SHARPLES is Professor of Learning Sciences and Director of the Learning Sciences Research Institute at the University of Nottingham. He has an international reputation for research in the design of learning technologies. He inaugurated the mLearn conference series and is Deputy Scientific Manager of the Kaleidoscope European 6th Framework Network of Excellence in Technology Enhanced Learning. His current projects include MyArtSpace for mobile learning in museums and the L-Mo project with Sharp Laboratories of Europe to develop handheld technologies for language learning. He is author of 160 publications in the areas of interactive systems design, artificial intelligence and educational technology.

JULIET SPRAKE is lecturer in the Design Department at Goldsmiths College, University of London and is studying for a PhD at The Bartlett, UCL. Her research interest is in making architecture and the built environment accessible to wider audiences in everyday places. She has worked with a range of organisations including: Futurelab, V&A Museum, British Library and the Urban Design Department London Borough of Lewisham to produce tours that engage learners in innovative and creative walking projects in urban environments. She was the project originator for *Mudlarking in Deptford* and has since worked with artists to develop audio projects that involve young learners in exploring the 'other' side of institutions using high and low technologies.

BRENDAN TANGNEY (www.cs.tcd.ie/tangney) is a Fellow of Trinity College Dublin and is a Senior Lecturer in the Department of Computer Science. He is co-director of The Centre for Research in IT in Education (CRITE – www.cs.tcd.ie/crite) a joint initiative between Trinity's schools of Education and Computer Science & Statistics. CRITE's research focus is concerned with the role of novel educational software tools in the relationship between teacher (and teaching style), subject content and the learner, with particular emphasis on the area of mobile devices and learning. He is co-author of over 60 peer reviewed scientific publications including "Local Area Networks & Their Applications" published by Prentice-Hall UK and Kaibundo Japan. He has been a visiting academic in the Universities of Sydney and Kyoto and previously worked for SORD Computer Systems in Dublin and Tokyo.

JOSIE TAYLOR is Professor of Learning Technology in the Centre for Research in Computing at the Open University, UK. Until recently she was involved with the EU-funded project MOBIlearn, running the workpackages on User Requirements and Evaluation, and Pedagogical Methodologies and Paradigms. She is interested in applying activity theory to the analysis of people engaging in mobile learning, particular in informal settings. Further interests include the gathering of requirements for novel technologies, and how people appropriate technologies into their daily lives.

GIASEMI VAVOULA is a visiting Research Fellow with the Institute of Educational Technologies, the Open University. She has previously worked as a Research Fellow on the EU IST project MOBILearn and the Kaleidoscope JEIRP project MELISA, both concerned with the use of mobile technologies in education and learning. She is currently involved in a number of projects as a mobile learning consultant, including the MyArtSpace project (leading the evaluation team of MyArtSpace – a mobile learning system to support school museum visits); and the ReFLEx project (performing requirements analysis of semantic browsing technologies for OU Library users).

DR. M. FELISA VERDEJO is Full Professor (Computer Systems and Languages) and Head of The Department Lenguajes y Sistemas Informáticos at the National Distance Learning University (UNED), in Madrid, Spain. She is an active member of Kaelidoscope, involved in CSCL and AI&ED SIGS. Her current research activity includes two interdisciplinary areas, Applied Natural Language Processing and Interactive Learning Enviroments. For further information :
http://nlp.uned.es/~fverdejo/

MICHAEL VOONG received his BSc degree from the School of Computer Science at the University of Birmingham in July 2006. Since October 2006, he has been studying as a full-time Ph.D. student under the supervision of Russell Beale. His research interests include mobile learning, location-based mobile systems, social networks and Artificial Intelligence applied to adaptive user interfaces.

A computer scientist by background, **NIALL WINTERS** is currently a RCUK Academic Fellow at the Institute of Education, University of London. Based at the London Knowledge Lab, he conducts research on mobile learning. As part of his current work, he is developing methodologies for the interdisciplinary design and development of mobile learning applications and in the process researching what it is that makes learning mobile

JOCELYN WISHART is currently a lecturer in science education at the University of Bristol specialising in teacher training. She first entered initial teacher education at Loughborough University in 1996 where she taught both PGCE Science (Physics) and PGCE ICT. Prior to that she taught Science, Psychology and ICT in secondary schools.

Her current research focuses on the use of mobile technologies to support teachers in training. Other recent research projects include developing an online resource for bioethics education and evaluating the use of online role play to teach safety on the Internet.

The CSCL Alpine Rendez-Vous