

Chapter 2

Mobile Learning: A Topography

So here is the paradox: the lived always seeks to be represented in some way and thus sacrifices the sense of life for the sense of words and meanings in order to relive. The journey is thus a double structure: one is the life of bodily engagement with the world; the other track is the life of reflection in order to represent textually, through images, through signs of all kinds, the experience of the journey. The double-tracked journey demands commitment, is often uncomfortable, takes too long and yet opens up new vistas, gives glimpses into different lives and can offer new possibilities for changes in direction, self-growth. (Schostak 2002, p. 2)

Introduction

In many ways writing this chapter, which attempts to provide a brief overview of the ‘history’ as well as the most pertinent current issues in mobile learning (research and practice) – as opposed to summarising the issues covered and foregrounded in this book, which we do in Chapter 1 – is like the double-tracked journey John Schostak describes in the quote above. Inevitably, no description, least of all the largely textual one possible within the confines of this book, can do justice to the breadth and depth of the rich tapestry that is the field of mobile learning with its many conference papers, presentations, case studies, project reports and pilots as well as its research papers and longer scholarly texts. The research underpinning this chapter necessarily involved attendance at, and the organisation of specialist conferences and engagement with relevant blogs and other social networking tools. And it is because of this ‘bodily engagement’ as well as the multimodal nature of the artefacts encountered – with video-enhanced PowerPoint or wiki presentations being the norm rather than the exception and with real-time blogging and podcasting of conference presentations being common – that it is difficult to do justice to the experiences and insights gained in a more traditional representational form. The reader, particularly if she is immersed in the practices of the field, rather than seeking initiation through the reception of this text, might well ask about the appropriacy of the chosen form of presentation. Yet, traditional academic discourse, even in the

field of technology-enhanced learning, is not dead, we feel. In fact, it might be argued that in order to achieve maturation, the field – in view of the external drivers and gatekeepers of reified knowledge or canonical status – requires the adoption of a more traditional scholarly form of communication as a necessary precursor to ensuring transcendence into an established academic discipline.

We feel that sufficient work has taken place now in the field of ‘mobile learning’ to warrant, and require of us in writing this book, to take stock of the key debates taking place in the field before setting out our own perspectives and deliberations. This chapter, therefore, is an attempt to provide an overview of the field, in terms of practical examples as well as key conceptual issues, in an attempt to sketch a broad context for the remainder of our discussion. That is, it attempts to summarise, present and comment on the main developments in mobile learning in order to provide a baseline for our own theoretical stance, which we have outlined broadly in Chapter 1, and which we will delineate more fully in Part II of the book. In this chapter, then, we offer a state-of-the-art overview of and commentary on the most pertinent discussions in the field. We neither analyse the issues raised in any detail nor do we necessarily discuss them in relation to our own conceptual and theoretical perspective, although such links are, of course, made from time to time.

A Brief ‘History’ of Mobile Learning

We want to start our topography with a diachronic overview using a structure proposed by Mike Sharples at the Becta seminar ‘Future Gazing for Policy Makers’ held in 2006 at the BT Government Innovation Centre, UK. Sharples outlined three phases of mobile learning at this event characterised respectively by:

- a focus on devices;
- a focus on learning outside the classroom; and
- a focus on the mobility of the learner.

We attempt here to delineate the affordances that mobile devices and attendant technologies can provide across these three phases by providing highly selective, yet illustrative, examples from both inside and outside of school. It seems important to stress that the respective foci are not exclusive to any one phase, but that each phase is arguably characterised by an emphasis on one focal point. For example, of late we detect a resurgence of interest in devices with the introduction of new devices such as Apple’s G3 (S) iPhone and phones that run Google’s Andriod Open Source Operating System.

The First Phase of Mobile Learning: A Focus on Devices

The beginnings of widespread experimentation with mobile devices for learning happened from the mid 1990s. The first phase is characterised by a focus on what devices, in particular PDAs, tablets, laptops and mobile/cell phones, can be used for in an educational context for instruction and training. This first phase makes productive use of the affordances of mobile devices and technologies such

as e-books, classroom response systems, handheld computers in classrooms, data logging devices and reusable learning objects.

Perry (2003) describes a UK project that took place in 2002–2003 in which some 150 teachers in 30 schools in England were given a selection of devices, mainly PDAs, to evaluate. The first phase of the project focused on senior management teams and how the devices support their work. The last phase involved a small number of schools being equipped with devices for the majority of staff and providing teachers with access to class sets in order to support their teaching. The project reported that the advantages were seen as being: portability, size, instant on (no start-up time), cost (relative to laptop computers), battery life (relative to laptop computers), and outdoor use. However, the disadvantages were seen as being: small screen, possibly not robust enough for schools, lack of technical support, data loss due to battery problems, problems with linking to networks. It would seem that even at this early stage, the concept of mobile/cell phone usage as a mediating tool for learning in the school context seemed to find positive advantages. Some of the disadvantages, like robustness and linking to networks, have diminished in the intervening years. However, as we shall see below, new challenges for learning with mobile devices have also emerged.

Also in the UK, McFarlane and colleagues conducted research on two ambitious initiatives, 'Learning2Go' in Wolverhampton and 'Hand-e-learning' in Bristol. These projects have enabled every pupil in a year group and their teachers to have a mobile device. These projects use considerable parental support to provide funding for these initiatives. The first report from the study (McFarlane et al. 2007) identified three issues as key contributors to the problems encountered and a less positive take-up than had been hoped for: lack of infrastructure in the schools – wireless capacity in particular; rushed initial training for teachers; the choice of science as the subject through which to promote device use (in science the majority of teachers were too preoccupied with a new curriculum to take on another challenge). However, following a project re-launch, McFarlane et al. (2008, p. 9) have subsequently reported that whilst 'the introduction of 1:1 mobile devices has been more problematic and complex in secondary schools than in primary',

since the re-launch there are encouraging signs of success. The size of the devices makes it possible for them to be taken from a pocket or bag and accessed very easily in class, in a car or bus on the way to and from school, even to be taken comfortably to bed. Large amounts of material (provided or learner-created) can be stored in one place on a device. Combined with these points, the instant-on facility means that access to stored material or the internet is immediate. The intimacy of the device in the hand seems to be attractive, especially to learners in the primary phase, and the size of the screen appears less daunting to some writers. Observations of primary phase learners record children writing curled up in chair or on cushions, walking around the class, standing in line waiting: all situations which would not support traditional writing tools or larger/heavier technological tools. (p. 9)

It is interesting to note in the above quote that affective issues such as 'the intimacy of the device' play a part in the appropriation of the device in the children's life-worlds and for meaning-making.

The above McFarlane et al. quote mentions the fact that ‘large amounts of material (provided or learner-created) can be stored in one place on a device’. A project that explored the increasingly sophisticated converged multimedia capabilities of smartphones as platform for storing learning resources is based in the UK’s Centre for Excellence in Teaching and Learning (CETL) in Reusable Learning Objects (<http://www.rlo-cetl.ac.uk/>). This work uses smartphones as a desk-top, placing rich multi-media mobile learning objects in the phone’s memory to scaffold (Wood et al. 1976) different types of learning. This work originates in Higher Education but the learning support/tasks are also appropriate for 14–19 year olds; a perspective confirmed by various presentations of this approach to school leaders in the South East of England (e.g. see Cook and Smith 2004) who are involved in the multi-billion pound Building Schools for the Future programme (see e.g. <http://www.teachernet.gov.uk/management/resources/financeandbuilding/bsf/>). Briefly, a selection of the 200+ internet based Reusable Learning Objects (RLOs) that the CETL repurposed for mobile/cell phones have been evaluated with consistently positive results (see Bradley et al. 2007; Smith et al. 2007). For example, in a pilot evaluation of the ‘self-tests’ and ‘basic guides’ shown in Fig. 2.1, Bradley et al. (2007) found that there were indications from students that they would use mobile learning objects. One thought it was ‘a good idea’ as you could look at something you needed to on the way home from class (this theme was echoed by other students, see below). In this sense, there is a link through to the Bitesize learning material from the BBC also described below; this moves the RLO approach into a context where the learning can take place outside the school or educational establishment in a way that is convenient to the learner.

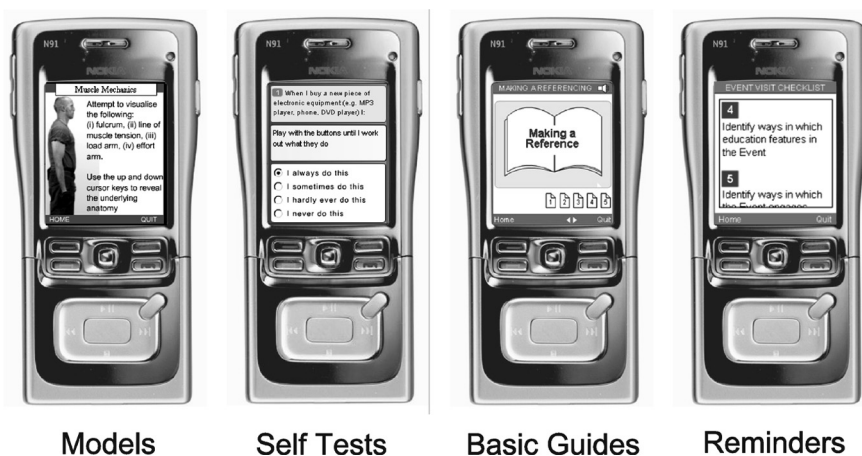


Fig. 2.1 Different types of learning support

Figure 2.2 shows students evaluating sports science learning objects. Smith et al. (2007) obtained some interesting results in the focus group when the students had a chance to use and evaluate a mobile RLO for muscle mechanics (which is also



Fig. 2.2 Students evaluating sports science RLOs

available as an internet version). Of particular interest was the observation that the mobile version complimented the web version of the RLO in a number of respects. Firstly, it was observed that having already seen and completed the web-based version, the mobile version could be used to reinforce and memorise what was learnt before an exam 'because, if you were on the train or whatever, to Uni. . . it would be perfect'. Secondly, it was agreed that the addition of audio in the mobile version added to a sense of immersion in the content and an increase in the level of involvement in comparison with the web version. 'It's more like you're in class. . . you are able to concentrate more'. Indeed, Fig. 2.2 illustrates that with headphones on, this form of learning enables immersion in the learning task. The subjects are completely engrossed in their learning activity. A number of students mentioned some other advantages of the mobile version, citing the element of distraction with computer versions: 'Because when I'm on the internet to be honest, I've got loads of different pages open and just flicking through – on the mobile you're just looking at the work' and 'I just think it's much better when you're travelling or whatever, when you're on a train going somewhere. . . If I had it on my phone, I'd look at it definitely'. Students also agreed that they would use the mobile RLO in context, e.g. in the gym to observe muscle mechanics.

Possible criticisms of the RLO approach include that it simply replicates the desktop experience, it is simply extending traditional pedagogic practice, it is not taking advantage of the ability of mobile devices to enhance context-to-context learning or, indeed, conversations across contexts. However, one advantage of the

RLO approach is that it provides rich, bite-sized learning that can be used outside and inside the classroom to reinforce learning; as such, this approach can be seen to be reaching into the second phase of mobile learning. The design of these mobile learning objects is not simple (see Bradley et al. 2009) and, as we saw above in the students' comments, sound is used more than in the internet versions in order to avoid having lots of text on a small, match-box sized screen. Indeed, this approach allows learners to take a 'proxy' of the teacher off-site with them as they engage in a field-study learning task (e.g. 'Reminders' were used in the Cook et al. (2007) study). This ability of pre-installed guides to scaffold off-site learning is something that is difficult to 'fit' into Laurillard's (2007) recent re-mapping of her own Conversational Framework, described and critiqued in detail in Part II of this book, to accommodate on-site and off-site learning. Furthermore, it is noteworthy that the ability to watch films, videos, etc on small screens was not generally seen as having much potential for success around 2005–07; however, such a view has proved incorrect as we have seen with Apple's iPod Touch and iPhone, and other equivalent mobile devices. Such devices are used in vast numbers to watch content on the move which can be downloaded through fast wireless networks like 3G, or indeed be sat waiting to view having previously been downloaded to a computer via the internet and then 'synched' to the mobile device. Mobile/cell phones that have the ability to combine rich multimedia, scaffolding guides and context awareness would seem to have a rich future, as we will see below. There is, however, one other important drawback to RLOs, which needs to be acknowledged here: compared with digital video recordings their production normally lies outside the scope of teachers and learners.

The Second Phase of Mobile Learning: A Focus on Learning Outside the Classroom

A focus on learning outside the classroom is a characteristic of the second phase of mobile learning. In order to reify our model of socio-cultural ecology, with its focus on socio-cultural practices and bringing those found outside educational establishments inside, in our discussion we attempt to highlight the meaning-making that is possible for a person in situations outside institutionally framed educational contexts. The affordances in the second phase can include field trips, museum visits, professional updating, bite-sized learning and personal learning organisers.

An early second phase project in the UK was 'HandLeR' (Handheld Learning Resource) (Sharples 2000; Sharples et al. 2001; Sharples et al. 2002). 'HandLeR' addressed issues of user interface design for mobile learning and developed software for a field trip (see Fig. 2.3). The system was designed to have multiple functions. According to Sharples et al. (2001), the generic HandLeR system had four main components:

- a set of tools to capture and annotate events,
- a web browser,



Fig. 2.3 Main screen and concept mapping tool from the HandLeR children's field trip interface (Source: Sharples, Corlett and Westmancott, 2001)

- a database manager to organise and relate the events as a knowledge structure, and
- a communications manager to support synchronous voice and data communication and asynchronous sharing of knowledge

and the capture tools included:

- a notepad with handwriting or voice recognition,
- an integral still and video camera, and
- a drawing package.

'HandLeR' used a 'mentor' that was intended to act both as a learning guide and to initiate activity, but which appears in reality as a screen metaphor. For example, clicking on body parts launches tools, such as the eyes for a camera, hands for a writing pad, and brain for a concept mapping tool. Figure 2.3 shows the main 'HandLeR' screen and the concept mapping interface.

An important conclusion from trials of the 'HandLeR' system was that the technology at that time (2000–2001) had severe limitations, which made it almost impossible to use. However, its main success was to establish the concept of mobile and contextual learning outside the classroom, for field trips and professional development.

A significant project in this phase was 'MOBilearn'. This research and development project ran for 33 months from January 2002 to March 2005 and involved 24 partners from academia and industry in ten countries (<http://www.mobilearn.org>). This project provided access to knowledge through appropriate learning objects, mobile services and interfaces. One aspect of the non-formal learning that the project tested extensively was with users at the Uffizi Gallery in Florence (<http://www.mobilearn.org/results/trial.htm>; Lonsdale et al. 2004) (Fig. 2.4).

Thus, the 'MOBilearn' project realised the shift in focus from learning with handheld devices towards support for the mobility of learning as it started to make use of location aware systems, i.e. the system deployed was able to provide information and guidance depending on the users' location. Furthermore, the lead partner, Giunti Labs, has subsequently developed a mobile extension to its 'Learn eXact'



Fig. 2.4 A student with a mobile/cell phone in front of one of Signorelli's paintings in the Leonardo room (Source: http://www.mobilearn.org/images/museum_trial/PIC_0024.jpg)

system based on results from 'MOBilearn' that enables context aware learning; this approach is being utilised in the 'CONTSENS' project (see discussion below in Phase 3).

The converged functionality that is now commonplace with mobile/cell phones (e.g. see the smartphones described in Phase 1) has led to their extensive use for learning outside the classroom. The technology simply could not support the pedagogy when 'HandLeR' was formulating its support for student learning. A recent example of a project that has taken advantage of the converged media affordances of mobile/cell phones is the 'Learning Lab Initiative' discussed in detail in the examples chapter later in Part I of this book. This project was conducted in Bangalore, India, at a government school with 13–15 year old pupils and consisted of several activity-based stages, where 'students were encouraged to move out of the classroom and bring into play new ways of exploring and understanding their environment, and visualizing this new knowledge' (CKS 2005b). Pupils were equipped with mobile/cell phones, ranging from GPS devices to multi-media capable mobile/cell phones (see Fig. 2.5). At the beginning of the project, students were supported with workshops and training sessions. The learning that took place with these mobile devices was evaluated impressionistically only by the Learning Lab team and, in general, the results appear to be optimistic with regards to learners and parents: learners were able to use the mobile devices in a competent way to organise their self-directed learning. Parents appear to support the use of mobile devices in curricular contexts and were, thus prepared to 'invest in any promising educational technology' (CKS 2005b). However, and as in the work by McFarlane et al. (2007) reported above, the teachers' role, as well as administrative aspects, were considered to contain challenges: teachers prefer hierarchical over peer-to-peer communications because there is a perceived loss of authority and communicative control. Also, from the teacher's perspective, there was a perceived inability to keep up with technology. Furthermore, from the administrator's viewpoint, there was a



Fig. 2.5 Students using image capture for a science assignment (Source: CKS 2005a)

perceived lack of control over the use of technology in the school. This project highlights a common theme in the literature, that teachers are struggling to keep up with the new modes of technology and digital media appropriation and that this may lead them to take measures to retain control in teaching and learning situations.

SMS alerts are starting to find a use in schools for communicating with students and parents, although the approach tends to take a one-way push mode as it is seen to provide benefits for co-ordination and management, for example students (and even parents) receiving notifications about aspects of school life, such as parent evenings. However, there is considerable scope for development in the use of this technology. For example, in Kenya there is a widespread availability of mobile/cell phones as well as no reliable fixed telecommunications network and no prevalent computer availability; Kenya also, like much of Africa, has unreliable surface mail. This has led to explorative work (e.g. Traxler and Dearden 2005a) that has examined the potential for using SMS to support learning and organisation in sub-Saharan Africa. The potential of this 'low-tech' approach seems enormous. SMS thus has the potential to reach parts of the world that traditional media, including the computer-based internet, is not able to reach.

The University of Wolverhampton, for example, has used SMS to improve retention and progression by extending and enriching the contact and support of higher education students on- and off-campus (see e.g. <http://www.jisc.ac.uk/whatwedo/programmes/elearninginnovation/melas.aspx>). The University of Dublin carried out a project which enabled students to send SMS to lecturers' laptops to anonymously ask questions without interrupting the class. It is up to the lecturer to respond immediately, wait until a number of questions arise or respond after class (see <http://www.cs.tcd.ie/crite/projects/mobile/Txt%20IT.php>). Griffiths University in Australia carried out a project learning Italian with SMS where 2–3 messages a day were sent about grammar, vocabulary news, literature and administration, homework etc (see <http://www98.griffith.edu.au/dspace/handle/10072/186>).

Traxler and Dearden (2005b) propose that it is possible to provide support for the curriculum through SMS: study guides giving week-by-week support; content in the form of hints, tips, outlines, lists, summaries, revision; reminders about assessment, contact, broadcast, discussion, video, meetings; discussion including feedback, seminar, query; pastoral support, and encouragement; urgent messages about cancellation and change.

The BBC Bitesize's (<http://www.bbc.co.uk/schools/gcsebitesize/>) is a secondary school revision resource for students studying their GCSEs (General Certificate of Secondary Education) in the UK that is made freely available to the world. Figure 2.6 below illustrates some of the features offered by this resource, which includes written content, interactive content, audio, video and games. Sometimes Bitesize allows revision questions to be sent to mobile/cell phones.



Fig. 2.6 BBC Bitesize (Screenshot taken September 14, 2008)

This form of push-learning has proved very popular, with 2.6 million unique internet users in May 2006, as a BBC press release dated August 15, 2006 suggests (http://www.bbc.co.uk/pressoffice/pressreleases/stories/2006/08_august/15/bitesize.shtml):

... last year 70% of all GCSE students used the service. It is the most innovative multi-platform revision tool there is. Bitesize fits teenagers' lives because it's available in so many different formats – online, on your mobile/cell phone or by pressing your red button [on the TV]. New technologies offered this year included downloadable MP3 s for English and Science, a multi-player revision game, RSS feeds, and a mind-mapping tool called Revision Map. Bitesize provides different ways of revising and helps to break up the monotony of what is an onerous and stressful period, but also provides an alternative angle to subject areas which may have been unclear before.

The Bitesize facility to download to mobile/cell phones appears to have been withdrawn, possibly because of the large number of hits that the service was getting. The way in which learners incorporate these resources into their learning habitus is not clear and more research is needed. However, a qualitative appreciation of the worth of such a resource for the meaning-making of school children can be gained from the quote below, taken from McFarlane et al. (2008, p. 10); for us this quote illustrates from a student's perspective why Bitesize and similar resources are helpful for mobile learning:

The one thing that has got me through my exams is Bitesize. So if there's anything in lessons that you don't understand or the teacher is busy with other things, instead of just sitting there, you can check – its got all the possible subjects for GCSE e.g. in RE its got all the subjects in religious studies... so Buddhism, Christianity, if you go to revise, its fairly quick the internet on this [the mobile device]. [Jake (Year 11)]

Although students at the moment do not tend to have phones with web browsing capability like Jake, there is a trend for them to have this affordance on the mobile devices they use outside of school (see Part III). Indeed, learning outside the classroom is now making use of the multimedia affordances of mobile/cell phones in increasing sophisticated ways. An approach that goes well beyond the RLO approach described in phase one above is the 'Skattjakt project' (Treasure Hunt; <http://www.celekt.info/projects/show/15>) (Figs. 2.7 and 2.8), developed at Vaxjo University, Sweden. Treasure Hunt is a mobile game that is designed to encourage young people to solve a mystery surrounding a castle:

The game is inspired by treasure hunts and the sport of orienteering. Up to 6 teams can compete currently. The game starts with a video detailing the mystery of why the ghost of Anna Koskull has come back and now the players need to help her solve the mystery of her late husband Frederick Bonde in order to free her spirit from limbo. After the players get briefed they are split into teams. The game starts and each team gets a different location on the campus to find. The locations are shown on the phone via the Flash Lite Application



Fig. 2.7 Screen shots from the 'Skattjakt project': the map, the ghost audio clue, and a question screen (Source: http://www.celekt.info/max/content/game_collage.jpg)

The focus on learning outside the classroom has become an active area of mobile learning practice and research. The diversity of learning in this phase is striking: from the Italian art gallery experience in 'MOBlearn', the use of Bitesize for revision in the UK, SMS-based learning across the world, through to game-based learning in the context of a mystery surrounding a castle in the Swedish Treasure Hunt project. Furthermore, the focus on the learner through co-design is coming to the fore, as is the emergence of an interest in context sensitive learning. And it is the latter to which we turn now.

Third Phase: A Focus on the Mobility of the Learner

The third phase is characterised by a focus on the mobility of the learner, the design or the appropriation of learning spaces and on informal learning and lifelong learning. Three important affordances can be distinguished: mixed reality learning, context-sensitive learning and ambient learning.

Mixed Reality Learning

Mixed reality learning, or mixed modes of representation, attempts to augment a learner's meaning-making by enabling them to participate in a media-rich environment rather than view the learner as consumer of content. Augmentation is intended here as a positive notion not as making up deficiencies. The provision of visualisations enables the learner to see aspects of the world in a new light and to discover facets of this augmented environment that are not easily perceived in the 'non-augmented' world. New environments and visualisations are created where the physical and digital interact and inform one another in real time.

Learners are enabled to construct content and 'place' it in context using mobile devices where other learners can access, and add to it. Meaning can, for example, be built around the specifics of a place and learning trails can be developed to foster meaning-making across and between multiple contexts. For example, a user with a camera phone and free reader software can scan Quick Response (QR) Codes (http://en.wikipedia.org/wiki/QR_Code) and automatically convert them into URLs, small books, images or videos etc. This act of linking from physical world objects is known as 'physical world hyperlinking'. Users can generate and print their own QR Codes and create their own physical learning environments very quickly (Fig. 2.9).

The 'MyArtSpace' project provides an example of a sophisticated mixed reality project (e.g. see Sharples et al. 2007; http://www.cultureonline.gov.uk/projects/in_production/my_art_space/). The aim of the project was to make school museum visits more engaging and educational. In one part of this project, school students explored a D-Day museum using mobile/cell phones to help them discover information about exhibits, take photos, and record audio and text notes. Photos and notes were sent automatically from the phones to their personal museum visit webspace, thus allowing students to construct personal narratives to share with family, friends and the general public. MyArtSpace, therefore, combines a learner's personal space (mobile/cell phones), physical space (museum, classroom) and virtual space (online

2D Barcodes in Mobile Learning



Fig. 2.9 QR codes (Source: http://farm1.static.flickr.com/96/214538909_0b5f7a233d_o.png)

repository and gallery). Sharples et al. (2007), who acted as external evaluators to the project, reported that

continuous evaluation and fine-tuning of the new technology in concert with the learning practice (including lesson planning, IT support, and activity planning) resulted in a system that met the initial design aims and provided a generally reliable service to museums. The study also identified issues that will need to be addressed in future services for museum or field trips, including the need to orient teachers and students to the experience, how to re-create the context of the visit back in the classroom, and finding a suitable business model for museums and schools to support a continued service.

Given the above comments it would appear that a co-design approach may be a productive way forward as a way of building learning systems that fit into the practices of both learners and teachers. Within a co-design perspective use and purpose are in the foreground, hardware and software design are brought together and it is acknowledged that client and beneficiary may not be using the artefact being designed. (See <http://en.wikipedia.org/wiki/Co-Design>) Furthermore, the key issue of orientating teachers points to the emerging need for staff development for those involved in such projects.

Other interesting work in the context of 'MyArtSpace' is that by Kevin Walker around 'personalised learning trails' (see e.g. <http://www.archimuse.com/mw2007/papers/walker/walker.html>) where visitors to museums, botanic gardens and cultural heritage sites aged 9 years and up created learning trails through the capture, editing and sharing of audio, photos and text during visits. The notion of personalisation in this example refers to conceptual frameworks into which information and experiences captured during a visit are placed in order for learning to be fostered.

Another approach to mixed-reality is provided by the 'CONTSENS' project (http://www.ericsson.com/ericsson/corpinfo/programs/using_wireless_technologies_for_context_sensitive_education_and_training/), funded by the European Commission's Mobile Learning: A Topography Leonardo Lifelong Learning Programme. The two year project, which started in April 2008, involves a European-wide consortium headed by Ericsson Education Ireland, with Giunti Labs, London Metropolitan University, ECLO (Belgium), Plovdiv University (Bulgaria) and Corvinno (Hungary). The project focuses on the development of appropriate training/learning materials for mobile learning enhanced by context sensitive and location-based delivery. In one work package, based at London Metropolitan University, consortium members are working on new environments and visualisations that are created where the physical and digital interact and inform one another in real time. This Cultural Heritage Learning work package extends work done on an earlier Cistercian Chapels project for archaeology students hosted by Sheffield University, UK, (<http://www.shef.ac.uk/hri/projects/projectpages>). Virtual reality representations of heritage sites can offer innovative solutions to the challenges which exist when learning about our cultural heritage. In order to allow for the greatest degree of flexibility in learning, the outputs of the Cistercian Chapels project are visualised in multiple ways (via multiple media);



Fig. 2.10 Visualisation in the Cistercian Chapels project

these include the web and site visits equipped with handheld devices including mobile/cell phones which use GPS to locate the user and present the appropriate reconstructions. Figure 2.10 gives an indication of visualizations that are used for this project.

Mixed reality learning is a powerful approach as it enables the learner to visualise something that may not have been seen in reality for centuries. The field-trip is a great tradition of school learning and mobile devices add new digital affordances to it.

Context-Sensitive Learning

Context-sensitive learning is a fascinating area that holds great potential for enabling learners to engage in meaning-making through interactive practice (Dourish 2004). 'Interactions' is taken here to be a term that encompasses conversation and non-verbal communicative acts like gestures and mouse clicks etc. Location-aware services, already used by emergency services, which use systems and tools that are able to detect the exact physical location of mobile device. For example, if a learner is stood in front of a painting by Picasso in an art gallery, the location-aware system can offer to transfer background information on the painting and the artist. In addition to services such as finding places and giving directions, location-aware systems can also help identify potential interactors in physical proximity of the learner. Applets on mobile devices such as the iPhone or iPod Touch utilise location awareness *inter alia* to tell the user which of their 'buddies' and friends are in physical proximity. Context-sensitive systems are aware of the activities of learners and can thus offer to give assistance. For example, if a student's course work is due in soon, the context-sensitive system can send a tip giving the location of resources that may help with an assignment. Thus, interaction-based approach to context should, ideally, continually derive what intervention is appropriate and can provide relevant services to aid learning. Context-sensitive systems, therefore, enable the delivery of appropriate learning content. Sharples (2006) pointed out that examples of context-aware learning could include: location-based guides and customised help systems; systems that enable activities in context, e.g. data logging; game learning offering services and options such as communication and awareness of other game players; customise content; adaptive interface and interaction, where the level of detail and order of presentation can vary and be made appropriate for context and for display on different devices.

'CAGE' is a system with an interaction model of context (Lonsdale et al. 2004), where context is seen as a dynamic and historical process that enables appropriate action (learning). 'CAGE', which stands for Context Aware Gallery Explorer, was developed as part of the 'MOBIlearn' project. This model of context is constructed through interaction between people, technology, objects and activities as proposed conceptually by Dourish (2004) (see below).

The 'CONTSENS' project, also already mentioned above, is one of several follow-ups to 'MOBIlearn'. It examines the use of wireless technologies for context sensitive education and training in museums and galleries, for language learning and for workplace learning. One 'CONTSENS' partner, again at the UK's London

Metropolitan University, has developed a series of mobile learning applications that are being used to support student teachers in exploring their knowledge and understanding of urban education in a meaningful context (Smith et al. 2008). An urban area close to London Metropolitan University is being used to explore how schools are signifiers of urban change and continuity of educational policy and practice from 1850 to the present day. The learning content developed for the mobile devices is directly relevant to the context of the learning needs and the location of the learners. It provides evidence of how the organisation and (re)structuring of urban space worked alongside educational discourses and policies to support participation in civic urban life and educate generations of working class children. The intention is to examine the community from the past, in order to engage, understand and inform the present, as urban space and society are made and remade. The project uses a complex interplay between mobile learning technologies, iconic physical infrastructures and educational discourses to visualise urban education through various collective images and representations. Many of the historical media are sourced through the British Film Institute, thus avoiding copyright issues. The project has created a digital 'technoscape' (Appadurai 1996; Sheller and Urry 2006; Urry 2007), essentially a visualisation that represents urban land, archaeological space, and subjects using a combination of social and cultural scripts. This resource is also appropriate for older school children. The idea in the project described here, however, is to scaffold the teachers' understanding of what is possible with mobile learning. The 'Urban Education for Trainee Teachers' project uses high end mobile/cell phones: HTC diamond (running Mediascape [<http://www.createascape.org.uk/>] on the Windows Mobile operating system) plus Nokia N95 (with QR codes running the Symbian operating system). These are used by small groups of two or three students at a time. They allow real research to be done on the move. The voice recorder on the phone is used to allow report writing and note taking for final presentations to be captured quickly and efficiently. Students can also produce video podcasts of themselves and even edit the videos they make on site using the phones. Finally QTVR (QuickTime Virtual Reality) movies of the structures under investigation can be viewed and manipulated in real time (see below).

Key questions that learners are asked to consider when on the tour are (Figs. 2.11–2.14):

- As you take the tour, identify continuities and change as evidenced by the educational settings.
- What do you learn about the socio-economic conditions over time? Which social class has been educated in this area? What indicators are there that the area has changed?
- What do you think has been the influence of religion in the area? How can you tell?
- What can the education of the past tell us about the present?
- What do you think have been the educational challenges faced by those living and working in the area?

Script segment 1 from the actual mobile tour:

- The school is different in design from the London 3-decker style of the time, with the hall at the centre and classrooms coming off this central point. What do you know of class sizes at the time?
- What does the close proximity of church and school buildings suggest? Can you see any indications of the relationship between education and religion in the architecture of the building itself?

Script segment 2 from the actual mobile tour:

- In the 1920s this area was known as the Ring Cross Estate and was in the second highest criterion for overcrowding and squalor, with people living in some of the worst slums. Why do you think the area was so heavily populated?
- What does the past and present housing stock suggest to you about the socio-economic status of the local community?

Script segment 3 from the actual mobile tour:

- The school is built in an open style, giving each classroom some access to the playground. When do you think it was built? What does the architecture suggest about the educational approaches at that time?
- Task: Looking at the exterior of the school, what changes do you think have been made to the school recently? What effect do you think this has had on the environment and the education of the children?
- Task: Using the local maps and old photographs sketch the road layout of the area in the nineteenth century.
- As you continue to walk down Georges Road you will come to St. James' School flats on the right hand side. This was an early attempt at change of use of a building as part of gentrification of the area.
- Task: Compare the structure of this building with those you have seen earlier. Can you see where the different entrances for boys, girls and infants would have been. How has the architecture changed? Why do you think this is?

The 'CONTSENS' project uses the IP Multimedia Subsystem (IMS). We will explore IMS in more detail in Chapter 14. Here we simply want to note that Erickson have developed a facility in some of its phones to use IMS positioning data to track group members. Zone-based notifications can be set to be sent when a specified person either enters or leaves the selected area. Clearly, in addition to certain affordances for learning, these forms of tracking and surveillance have major ethical implications; we will return to this point in Part III.

Ambient Learning

Ambient learning makes use of digital artefacts to augment the environment and enable learning (see e.g. Price 2007). In essence, digital artefacts are placed within the real world, the ambience, in order to enhance that world. Thus, technological tools are used to augment user activity in context. This view of context invests effort in designing a rich environment that in turn mediates innovative forms of learning



Fig. 2.11 The location of the Urban Education for Trainee Teachers project



Fig. 2.12 Images from the Urban Education for Trainee Teachers project

and teaching. For example, Rogers et al. (2004) describe approaches to bridging the gap between outdoor fieldtrips and computer-based indoor learning activities with such devices as the PDA pinger

which was programmed to show sporadically an image of a plant or animal together with a voice-over about an aspect of its habitat. This happened whenever the children walked passed a pinger that was hidden in a pre-determined place in the woodland. The information displayed was intended to draw the children's attention to a part of the woodland at pertinent times for them to think and reflect upon it. (Rogers et al. 2005)



Fig. 2.13 Images from the Urban Education for Trainee Teachers project



Fig. 2.14 Images from the Urban Education for Trainee Teachers project

Essentially, a learner walks up and uses learning support (e.g. large screens to share information from mobile devices). Such an approach could potentially lead to technology-enabled learning spaces, a theme we will return to in Chapter 14.

The latest trends in mixed reality at the time of writing involve a blurring of distinction between virtual and real worlds and ambient learning. For example, the ‘Mobile Augmented Reality Applications’ (MARA) project from Nokia (<http://research.nokia.com/research/projects/mara/index.html>), is designed to identify objects viewed on the screen of a camera phone (Fig. 2.15). Augmented reality in this context indicates that supplementary information is overlaid onto the camera picture of the real world. Thus, MARA explores how to make use of camera equipped mobile devices as platforms for ‘sensor-based, video see-through mobile augmented reality’. Developments like these could one day make it easier to navigate the real world by superimposing virtual information on an images of your surroundings. If a phone has the appropriate software and hardware set up it would be able to identify restaurants, hotels, and landmarks and provide Web links and basic information about these objects on the phone’s screen. In addition, the system

Fig. 2.15 A prototyped Nokia camera phone, equipped with sensors and MARA (Source: Nokia Research Center at <http://research.nokia.com/files/maraobj.bmp>)



could also be used to find nearby friends who have phones with GPS and the appropriate software. David Murphy, an engineer at Nokia Research Center, Helsinki Finland, has described 'MARA' as being

able to pull together the information from the three sensors to pinpoint the location and orientation of the phone. The software then scours a database of objects—which can be loaded onto a phone or can be accessed through a network connection—to determine which object would be visible to the camera. Once visibility is determined, MARA highlights the objects and provides extra information and hyperlinks if available. So, if a nearby restaurant is in the database and within view, the software could display the menu and wait time, and by clicking on the hyperlink, you could visit the restaurant's website... This capability becomes particularly compelling when people, as well as buildings, are incorporated into the database. If you have a GPS sensor in your mobile device and elect to share your location... people could click on you to link to your blog... You could go to a football match and be able to see information on the players, or ball movement, or tactics by looking at the field with your device... MARA has an additional feature to access a satellite view of your location and nearby landmarks, simply point the phone's camera at the ground. The software infers the orientation and displays the map. (<http://www.technologyreview.com/Biztech/17807/>)

Thus, we can see a shift towards mobile devices capable of enabling mixed reality and ambient learning. In this sense we are seeing the interpenetration of the real world and the digital world. Such affordances will enhance our ability to teach a vast range of subjects, from biology to chemistry through to history and geography. However, as we pointed out above, there are ethical considerations when enabling tracking and when broadcasting personal information; clearly care must be taken when children are exposed to these technologies, issues we return to in some detail in Chapter 14.

Interim Summary

We conclude from our discussion so far that there is much to commend mobile/cell phone usage as a mediating tool for learning inside and outside of educational institutions. Emerging trends over the three phases of mobile learning are, as we have seen, the enhancement of the desktop, support for learning outside the classroom and the notion of learner mobility with location and context sensitive systems that enable life-long learning transitions across multiple contexts. Ambient and mixed-reality systems and environments may soon be teaching us about themselves. Wide area educational gaming may draw in learners who may be at distance to the school. Also, we saw in the ‘CONTSENS’ project that zone-based notification provides a form of tracking and surveillance that has major ethical implications.

There is still much work to do if mobile devices are to be widely adopted for learning in educational institutions. As Sharples (2006) pointed out, there are many issues that for schools to resolve, these include:

- How will schools respond to children bringing in their own mobile multimedia communications devices?
- How can schools manage the tension between informal networked learning and formal institutional learning?
- What types of mobile learning are appropriate and cost-effective for schools, colleges and universities?

Our approach throughout this book is to try to provide compelling arguments, both theoretically and through practical examples, for the inclusion of mobile/cell phones in the curriculum. Of course it is for educational institutions and the professionals working in them to decide. Looking into the future, Sharples (2006) points out that lifelong learning support is needed; specifically we need to design a mobile lifelong learning environment; simply providing a mobile office environment, which is how for example a laptop is typically set up, is not the most effective way forward as far as education is concerned.

Let us now turn to the next part of our topography, namely an examination of conferences, events, organizations and journals in the field.

Specialist Conferences and Events

mLearn

mLearn, arguably the main international event on the annual mobile learning calendar, which is attended by delegates from across the world, first took place as the ‘European Workshop on Mobile and Contextual Learning’ at Birmingham University in 2002 and has since become the most important academic conference in the field of mobile learning internationally.

Long papers are reviewed by an international panel. In addition, conference organisers tend to welcome short papers and poster presentations. It has taken place in London (2003; <http://www.lsd.org.uk/events/mlearn2003/>), Rome (2004; <http://www.mobilelearn.org/mlearn2004/>), Cape Town (2005; <http://www.mlearn.org.za/>), Banff (2006; <http://www.mlearn2006.org/>), Melbourne (2007; <http://www.mlearn2007.org/>), Telford (2008; <http://www.mlearn2008.org/>) and Orlando (2009; <http://www.mlearn2009.org/>) and authors of this book have attended, and presented at various mLearn conferences in recent years. In 2010 the conference will take place in Malta and focus on the future of mobile and contextual learning (<http://www.mlearn2010.org/>).

mLearn 2007 in Melbourne focused on ‘making the connections’ and stimulated debate about theories, approaches, principles and applications of mobile devices supporting learning. Papers explored conceptual questions around mobile learning, pedagogical considerations, educational affordances of mobile devices, standards for mobile learning, findings from and evaluations of small- and large-scale mobile learning projects across phases and sectors including informal learning or guides for practitioners.

In 2008 mLearn was under the metaphorical banner of ‘the bridge from text to context’, in part motivated by the location of the conference, Ironbridge in Shropshire, the birthplace of the Industrial Revolution, as well as the increasing importance of location awareness. The choice of conference theme, unsurprisingly, reflected changing priorities in the field. In part, the 2008 papers show that the growing functionalities of mobile devices are leading to an extension of traditional notions of context, normally bound up with spatial proximity, through social networking tools across existing geographical and socio-economic boundaries. Among other things, the 2008 conference problematised issues around the relationship between discourse, identity and knowledge in ever more global contexts in learning with increasingly ubiquitous mobile technologies in and across formal, informal and work-based contexts. Whilst the number of practical examples of use of mobile devices for pedagogical purposes in and across a number of spheres and sectors of education is undoubtedly growing – most noticeable in 2008 we saw the growth in the number of large(r) scale projects (city-, Local Authority-, sector-wide) reported on –, the extent to which that work is underpinned by explicit theoretical considerations remains limited as does the number of papers that address conceptual and theoretical considerations. Nevertheless, the number of conceptually and theoretically underpinned papers is growing with a number of presenters, for example, trying to use Activity Theory as analytical frame for explaining their data. This might well have been linked to Yrjö Engeström bring one on the keynote speakers in Telford. Judging by the 2008 proceedings, whilst mobile learning has clearly matured and consolidated, it still has some way to go before it can be said to be theoretically grounded.

The 2009 conference was divided into the following four strands: global development, contextual learning, emerging technology integration and emerging vertical application. Noticeably, the field of language learning attracted a number of papers.

IADIS Mobile Learning

IADIS is the International Association for Development of the Information Society (<http://www.iadis.org/>). It is a non-profit association focusing on technological developments and human computer interaction. IADIS publishes journals and sponsors several annual conferences, one of which is International Mobile Learning Conference. The themes of this conference series have become more concrete over the years and reflect the move outlined in the diachronic overview away from general issues surrounding the device towards an understanding of the mobility of the learner. The first IADIS Mobile Learning Conference took place in Qawra, Malta in 2005 (<http://www.iadis.org/ml2005/>). The second event was held in Dublin, Ireland in 2006 and encouraged in 'particular empirical research informed by theories of learning such as collaborative, contextual, constructivist and constructionist approaches, which are well suited for mobile learning experiences and scenarios' (<http://www.iadis.org/ml2006/>). Mobile Learning 2007 took place in Lisbon, Portugal. The 2007 event in particular, but not exclusively, aimed 'to enrich the Big Issues in Mobile Learning debate with an international perspective and with empirical research that will further contribute to forge understanding of the Big Issues in Mobile Learning' (<http://www.mlearning-conf.org/2007/>). Mobile Learning 2008 took place in the Algarve, Portugal and in particular aimed 'to further our understanding of mobile learning from the standpoint of learner mobility' and it sought to explore how the multiple perspectives of mobility and the interactions among these influence and enhance current definitions, design, and evaluation of mobile learning (<http://www.mlearning-conf.org/2008/>). The 2009 event, in Barcelona, Spain, explored the 'transition from content consumer to content creator in experiences that take advantage of the learning opportunities this provides'.

Handheld Learning

Another important event on the annual mobile learning calendar is Handheld Learning (<http://www.handheldlearning.co.uk/>), an annual conference for mobile learning practitioners from schools, further and higher education as well as adult learning and policy makers taking place in London. The conference offers themed workshops, seminars and plenaries hosted and supported by relevant organisations and companies as well as keynote addresses by experts in the field. The focus is very much on practice and the event is also a showcase for companies and service providers to present their wares and services. The event is also a forum for (government-funded) organisations involved in education technologies to present their work. The Handheld learning website features an online discussion forum in which some pertinent issues around mobile learning are discussed between conferences and also makes some of the talks available for online viewing.

Budapest Mobile Learning Conference Series

There is also some very interesting and important work on mobile learning taking place in Continental Europe, some of which is documented in English some is not. In particular Kristóf Nyíri, in association with the Hungarian Academy of Sciences, has been running a series of annual conferences on mobile learning with a particular focus on philosophical issues for a number of years (<http://www.socialscience.t-mobile.hu/>). A recent conference in September 2008 in Budapest focused on mobile communication and the ethics of social networking and brought together an interdisciplinary range of speakers from Hungary, Germany and beyond, in particular the US and the UK. The proceedings were published as Nyíri 2009.

WMTE

The Workshop on Wireless and Mobile Technologies in Education or WMTE series began in Vaxjo, Sweden in 2002 (<http://lttf.ieee.org/wmte2002/>). This event led to the series of international conferences held in Asia and in Europe in the field of mobile learning. Being associated with the IEEE has meant that WMTE has taken a technical design and development perspective, but this has not precluded other perspectives. The second workshop was held nearly two years later in Jhongli, Taiwan in 2004 (<http://lttf.ieee.org/wmte2003/>). The conference theme for this second meeting was 'Mobile Support for Learning Communities'. The third workshop, held in 2005 at the University of Tokushima in Tokushima City, Japan (<http://lttf.ieee.org/wmte2005/netscape/>) focused on 'Learning Everywhere: Design and Challenges for Ubiquitous Learning Society'. The fourth WMTE 2006 workshop in 2006, Athens, Greece (<http://www.ask.iti.gr/wmute/2006/others/>) had a diverse set of themes. The fifth WMUTE was held two years later in 2008 in Beijing, China (<http://www.wmute2008.org/>). The proceedings from some of these conferences are available at: <http://csdl2.computer.org/persagen/DLPublication.jsp?pubtype=p&acronym=WMTE>

Professional Association

International Association for Mobile Learning (IAMLearn)

Out of the work of the mLearn community and Kaleidoscope (see below) a professional body, the International Association for Mobile Learning (<http://www.iamlearn.org>) has emerged. IAMLearn, which organises mLearn, is a membership organization which aims to promote excellence in research, development and application of mobile and contextual learning. Through its website, the association collates and disseminate information about new projects, emerging technologies, and teaching resources.

Organisations with a Particular Interest in Mobile Learning

WLE Centre: Mobile Learning Symposia and the London Mobile Learning Group (LMLG)

Since 2007 the Centre for Excellence in Work-based Learning for Education Professionals (<http://www.wlecentre.ac.uk>) at the Institute of Education, London, which sponsors the work of the London Mobile Learning Group (<http://www.londonmobilelearning.net/>) of which the current authors are members, has organised a number of mobile learning symposia leading to important publications in the field. The February 2007 event (http://www.wlecentre.ac.uk/cms/index.php?option=com_content&task=view&id=105&Itemid=39) aimed to contribute towards the emerging research agenda for mobile learning and featured papers concerned with definitional aspects of mobile learning, emerging functionalities such as digital augmentation as well as pedagogical issues and led to the publication of Pachler (2007), which can be downloaded free of charge from (http://www.wlecentre.ac.uk/cms/files/occasionalpapers/mobilelearning_pachler_2007.pdf) as part of the WLE Centre Occasional Papers series (http://www.wlecentre.ac.uk/cms/index.php?option=com_content&task=category§ionid=7&id=34&Itemid=50). In December 2007 the second symposium took place (<http://www.milrm.wle.org.uk/>), which was entitled 'Research methods in mobile and informal learning' and explored the challenges inherent in mobile devices for researching emerging practices and uses. The best papers of the symposium were published as Vavoula et al. (2009) by Peter Lang. The third symposium in the series in March 2009 (<http://symposium.londonmobilelearning.net>) looked at mobile learning cultures across education, work and leisure, in particular it considers experiences related to the learners' life worlds, agencies and cultural practices, in out-of-school, informal contexts and how they relate to learning and practices at work and formal education.

Not only did a number of publications emerge from this series of events but also did the idea of working group of researchers emerge which has since formalised itself and grown into the London Mobile Learning Group (LMLG; <http://www.londonmobilelearning.net>). The group brings together an international, interdisciplinary group of researchers from the fields of cultural studies, sociology, semiotics, pedagogy and educational technology. Since its inception, the group has worked on a theoretical and conceptual framework for mobile learning around the notion of a socio-cultural ecology documented in this book. The analytical engagement with mobile learning of the group takes the shape of a conceptual model in which educational uses of mobile technologies are viewed in ecological terms as part of a socio-cultural and pedagogical context in transformation. The members collaborate on various projects and publications with each other, and organise joint events. Over the years they have organised workshops and symposia at national and international conferences such as the annual conference of the American Research Association (AERA) (2009), the Kongress der Deutschen

Gesellschaft für Erziehungswissenschaft (DGfE) (2008 and 2010), the CAL biennial conference (2009) and the Alpine Rendez-Vous (2009). For details see the LMLG website.

Futurelab

Futurelab is a not-for-profit organisation that explores the potential offered by digital and other technologies through developing resources and practices that support new approaches to learning for the twenty-first century (<http://www.futurelab.org.uk/>). According to its website, Futurelab works in partnership with others to: incubate new ideas; share evidence and practical advice to support the design and use of innovative learning tools; communicate the latest thinking and practice in educational ICT; provide the space for experimentation and the exchange of ideas between the creative, technology and education sectors. As the screenshot from their home page shows (captured September 14, 2008), Futurelab's work towards achieving these aims through projects, resources, events and networks. It has produced several notable reports on mobile and informal learning, which we have drawn on in the research for this book (Fig. 2.16).

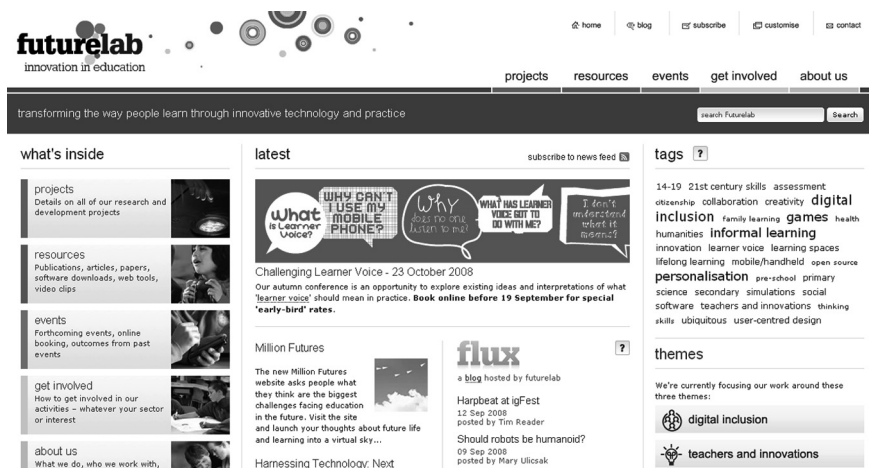


Fig. 2.16 Futurelab homepage

Interestingly, the above screenshot has as a speech-bubble/caption for their October 2008 conference which reads ‘why can’t I use my mobile/cell phone?’, a student-centred theme that is central to this book.

Becta

Becta (<http://www.becta.org.uk/>) describes itself on its website as the UK’s ‘government agency leading the national drive to ensure the effective and innovative use of

technology throughout learning'. Becta, focuses on schools and Further Education, has four main roles:

- strategic adviser to government;
- co-ordinating the government's e-strategy for education, developing and implementing an overarching delivery strategy and establishing effective programme management;
- providing insight through analysis and research;
- working to deliver specific elements of the e-strategy.

Becta funds various research reports on mobile learning that have been drawn upon in this book. Of particular interest to the themes of this book is the recent home access initiative:

Over one million children do not have technology and access to the internet in their home and this perpetuates the social and digital divide and disadvantages children. To begin to address the imbalance the Government is now considering establishing a programme of activities to ensure that every family with 5- to 19-year-old learners in England, irrespective of their circumstances, has access to ICT resources and support at home. (<http://live.industry.becta.org.uk/display.cfm?cfid=1476190&cftoken=29154&resID=37031&page=1714&catID=1620>)

UK members of the LMLG have been working closely with Becta in support of the effective use of educational technologies in learning and teaching.

Kaleidoscope

Kaleidoscope was a European research network of excellence involved in shaping the scientific evolution of technology-enhanced learning (<http://www.noekaleidoscope.org/pub/>). The project was funded from January 2004 to December 2007. The network ran a Mobile Learning Special Interest Group (SIG), which turned into the International Association for Mobile Learning (IAMLearn). The SIG was supported by a website and generated two important reports: Big Issues in Mobile Learning Report (Sharples et al. 2008), and the report of the Alpine Rendez-Vous workshop (Arnedillo-Sánchez et al. 2007). The themes of the IADIS Mobile Learning Conference in Lisbon in 2007 were also based around these reports.

G1:1

G1:1 (<http://www.g1on1.org/>), pronounced as 'G one one', is a global network of research teams to which the authors of this book belong. G1:1 believe that every learner will soon have a personal mobile computing device that is wirelessly connected, and which will enable multimedia input and output. G1:1 propose that the 'fundamental infrastructures of education are being dramatically transformed with 1:1 technology together with other interactive media'. As we have seen elsewhere

in this book, with the convergence of affordances onto a single mobile device our private, informal and formal spaces are becoming intermingled. Learning, community and social communications, working, entertainment, commerce, shopping and other activities are becoming intertwined. Currently, G1:1 aims at promoting the rapid advancement of research-based understandings of 1:1 technology-enhanced learning that will provide the foundation and disseminate information for progressively extending its impact throughout the world.

Specialist Journals

IJMBL

The International Journal of Mobile and Blended Learning (<http://www.igi-global.com/ijmbbl>) is a new journal and, as a partner of IAmLearn, publishes papers from the MLearn conference. The journal aims to provide a forum for researchers in the field of mobile learning to share their knowledge and experience.

IJMLO

The International Journal of Mobile Learning and Organisation (IJMLO) 'intends to establish an effective communication channel among decision makers and policy makers in business, government agencies, and academic and research institutions which recognise the important role mobile learning may play in organisations'. (<http://www.inderscience.com/browse/index.php?journalCODE=ijmlo>). Since its inception in 2007 it has published four issues a year and covers a diverse range of topics, ranging from globalisation to ethical and copyright issues in the context of organisations.

IJIM

International Journal of Interactive Mobile Technologies 'aims to focus on the exchange of relevant trends and research results as well as the presentation of practical experiences gained while developing and testing elements of interactive mobile technologies. The objective of the journal is to publish and discuss fundamentals, applications and experiences in the field of interactive mobile technologies in learning and teaching as well as in industrial and other applications' (<http://www.ijim.org/>). IJIM produced one issue in 2007 and is now generating 3/4 issues a year. In 2008, IJIM published a special issue of the mLearn 2008 conference papers.

Special Issues on Mobile Learning

A number of journals in the field of computer-assisted, technology-enhanced and distance learning have featured special issues on mobile learning to provide an

in-depth perspectives. They include the *Journal of Computer Assisted Learning* (JCAL; <http://www3.interscience.wiley.com/journal/118532977/issue>) in 2007 (Vol. 23, No. 4), the *International Review of Research in Open and Distance Learning* (IRRODL) of Athabasca University (Vol. 8, No. 2) also in 2007, available free of charge at <http://www.irrodl.org/index.php/irrodl/issue/view/29>, and in 2008 the *Journal of the Research Centre for Educational Technology* (RCETJ) of Kent State University (Vol. 4, No. 1) also available free of charge at <http://www.rcetj.org/?type=ci&id=5769>. RCETJ will publish a special issue with selected papers from the research strand of Handheld Learning 2009.

Key Issues in Mobile Learning

In the third part of our topography, we turn to the key issues emerging from the literature in the field.

Challenges in the implementation of technology in education are plentiful. There is not the space here to discuss the generic issues, such as for example those around assessment, that are well documented in the burgeoning literature on educational technology. Instead, in the following we focus on those issues, which we consider particularly relevant to mobile learning, as well as ones which we deem to be central to the successful adoption of mobile devices in education. And it is the latter we will start with here.

Development for Educational Professionals and Mobile Learning

According to a recent teacher voice omnibus survey conducted by the National Foundation for Educational Research (NFER 2008) amongst 1,000 teachers in November 2007, a sizeable minority (33%) feel unprepared to exploit the technology available to them and say they lack the necessary skills. The report also suggests that there continues to be a demand for basic skills training in relation to what might be called established technologies such as personal computers and visual technologies such as interactive whiteboards. Kitchen et al. (2007, p. 11) report in a recent study that most teachers perceived a need for professional development in using technology, with primary school teachers identifying development needs in the area of the creation of digital video material whereas secondary teachers perceived a need for CPD in supporting learners' use of digital video.

The UK government has adopted the term 'educational e-maturity' of late, by which they mean the 'integration of technology-based applications and processes into all key aspects of... practice and operation' (BECTA 2007, p. 19), to capture the degree of preparedness by all stakeholders at all levels. Concerns about difficulties in realising the potential of mobile devices is shared by Shin, Norris and Soloway (2007, p. 33) who, writing about K-12 contexts, argue that substantive technical and instructional support for teachers is required to build the necessary skills and confidence.

These figures and findings pose some important questions for us around the ‘maturity’ of the education sector, in particular as regards compulsory education. The challenges in relation to the use of ‘newer’ technologies, such as mobile devices, can be assumed to be considerably greater and to represent an urgent issue to be addressed by the education system to ensure the successful implementation of these technologies; an issue, which we see closely linked to strategic leadership at meso (institutional) and macro (systemic) level. However, a recent small-scale study by Kukulska-Hulme and Pettit (2007) suggests that the situation is not much better in higher education settings. They argue (p. 114) that a lack of personal experience of mobile learning represents a major barrier to its uptake and integration in teaching and learning. The authors also make the valid point that compared with other technologies, such as personal computers, there tends to be a much greater degree of specificity in the technical skills required depending on the particular device being used.

In their report on teacher learning with digital technologies, Fisher et al. (2006, p. 2) note that there is very little research on how teachers might learn with digital technologies and they identify the activities in Fig. 2.17 as purposeful for teacher learning.

Knowledge building	<ul style="list-style-type: none"> • adapting and developing ideas • modelling • representing understanding in multimodal and dynamic ways
Distributed cognition	<ul style="list-style-type: none"> • accessing resources • finding things out • writing, composing and presenting with mediating artefacts and tools
Community and communication	<ul style="list-style-type: none"> • exchanging and sharing communication • extending the context of activity • extending the participating community at local and global levels
Engagement	<ul style="list-style-type: none"> • exploring and playing • acknowledging risk and uncertainty • working with different dimensions of interactivity • responding to immediacy

Fig. 2.17 Clusters of purposeful activity with digital technologies (Source: Fisher, Higgins and Loveless 2006, p. 2)

McFarlane et al. (2007, p. 6) note that across their sample of three schools different approaches to teachers’ continuing professional development (CPD) are in evidence and that none of them has proved to be superior to date. The report identifies the following elements as beneficial: opportunity to explore how devices work

hands-on prior to considering their application in teaching and learning; the ability to confer with mentors and colleagues; as well as starting small and building up slowly.

Teachers' confidence, their relationship with their classes and their attitude to taking risks appear to be the factors having the greatest effect on the pace of implementation of mobile learning into teaching and learning. The pace of implementation increased when teachers found material and/or examples that they felt comfortable with. (p. 7)

Public, Personal and Intimate Spaces and Ethical Considerations

An ever more important issue in view of the growing ubiquity of wireless technologies and wireless communication (networks) by virtue of wireless functionality becoming cheaper and getting more readily attached to machinery, embedded in the environment and, as in the case of wireless medical devices for example, under people's skin, is the ethical dimension and the implications for the privacy of the individual user. Examples are machine-to-machine communication without the knowledge and specific consent of the owner/operator of mobile devices, such as the mining and exploitation of datalogs, or the transmission of location data through RFID (Radio Frequency Identification) tags in credit cards, passports or items of clothing. RFID tags are often applied to or incorporated into objects such as a product (e.g. on a parcel for tracking shipment progress), animals, or even a person for the purpose of identification and tracking using radio waves. An example of wireless technologies being used to develop new business models around so-called 'smart services' are pay-as-you-drive car insurance schemes. These developments have led to assertions by specialist commentators, such as the technology correspondent of *The Economist*, that the implications of wireless technologies are huge and that the world we will live in will be fundamentally different to the one we know now with machines, metaphorically speaking, getting eyes, ears and a voice, through interconnectivity by way of ad-hoc mesh networking (an approach to routing data, voice and instructions between communication nodes). This, it is argued, poses a considerable challenge for current models of privacy protection which are based, by-and-large on a bi-directional relationship between the consumer and service provider. (For details see *The Economist* Special Report on wireless technology April 26, 2007) There are also concerns about the commodification of users and the content they generate using digital technologies (see e.g. Hodgkinson 2008; Jarrett 2008; Petersen 2008)

In relation to learning, the use of mobile devices tends to be characterised by digital recording as well as sharing of experiences. These acts invariably leave multimodal trails of our lives, and that of others whose consent it might, or might not be possible to obtain. And, there are attendant issues of secure storage and use/exploitation by whom and for what purpose. Whilst the use of mobile devices and their ubiquity in learners' life worlds allows for new, and potentially very fruitful synergies between activities inside and outside formal education situations, there exist increasing anxieties about the potential negative impact of the use of records generated in the context of users' private lives for other purposes. Employers, for

example, reportedly increasingly explore the digital trails available about potential employees on the internet. As mobile devices become more and more like desktop PCs, for example, enabling affordable internet access, the same challenges come to the fore in relation to user data and their storage that already exist in cyberspace in relation to things like users search profiles, the online storage of pictures and other data files (incl. e-mails, calendars, chat records, documents, maps, shopping habits and product preferences). (see e.g. WOZ Spezial 1+2, 2008 available at http://www.woz.ch/files/WOZ_1.08_google-spezial.pdf; Albrechtslund 2008; Zimmer 2008)

There is, of course, also the question about the extent to which the act of recording and documenting experiences digitally actually interferes with the nature of these experiences for participants, for example in terms of their uninterrupted enjoyment due to the creation of psychological barriers and inhibitions caused by the presence of mobile devices or psychological pressures in relation to information overload caused by the instantaneous nature of available information.

The use of mobile technologies has to be viewed as located within the contingencies of specific socio-cultural and economic environments which in themselves are bound up in geopolitical changes. With reference to work by Baumann (2000), Stone (2008, p. 177) discusses the notion of 'liquid modernity' which to him suggests a certain fluidity of individuals, 'increases everyone's self-consciousness and individualizes responsibility for well-being and self-attainment, encouraging less static modes of being'. Clearly, mobile technologies have a significant potential to contribute to this increasing freedom 'to choose our way in the world'. Another important role for mobile technologies is in relation to what constitutes individual identity. With Stone (2008, p. 179) we assume that individual identity is 'a work in progress, which reflects the dialectic relationship between self-reflexive understandings and externally enforced subjectivities', that they are 'multiple, fluid and contingent', but not underpinned by a 'true self' that finds multifaceted articulation according to different contexts.

A project which is worked upon within the ordinariness of everyday life through a combination of moments of self-contemplation, familiar interactions with family, friends and colleagues, subconscious reactions to strangers and the discursive nature of structural influences. ... For in 'liquid modernity' our lives are fragmented into a 'succession of ill-connected episodes', the narrative for which is no longer some notion of Cartesian transcendence nor the negotiation of conformity within the structured identities of modernity, but a desire and a need to communicate with some sense of who we are at each juncture. (Stone 2008, p. 179)

Traxler (2007b, p. 260) rightly notes the fluidity of social norms caused by the increasing co-presence of actual (face-to-face) and remote (technologically-mediated) social interaction. In his terms, mobile/cell phones have created 'simultaneity of place', which has led to a constant 'permeability' between public, private and intimate social spaces. Many readers will have found themselves astounded, for example, by the intimate nature of mobile/cell phone conversations conducted by others in their presence and have wondered about their intrusion into the private

lives of others or/and perceived the inability of escaping the exposure to such conversations, for example due to them being held in a loud voice in a train carriage, as an intrusion into their private spheres. Or, what of the seeming inability of many users to ignore incoming phone calls even if they are in the midst of a face-to-face interaction with a co-present other? Mobile/cell phones have led to a redrawing of the boundaries between public and private talk and how we interact with our social world.

Most young users... are able to establish intimate spaces for shared presence when they talk on the phone or have a text-message conversation.... The experience of presence is important in most interpersonal communication situations in order to establish a feeling of trust and social bonding. (Stald 2008, p. 154)

Another interesting point Traxler makes about the issue of privacy with reference to work by Bull (2005) from the field of leisure studies relates to the use of media players. He notes that the use of media players can be understood as an attempt by users to 'inhabit' and structure the spaces within which they move and to fill the spaces in between acts of communication. Stald (2008, p. 154) points out the potential of such devices to 'shut off the surroundings and establish a private space where one's psychological presence is transferred to another symbolic place of experience'. With reference to Biocca et al. (2003), she makes the distinction between physical and social presence with the latter defined as 'a state that varies with medium, knowledge of the other, content of the communication, environment, and social context'. Stald (p. 156) also refers to Gergen's (2002) notion of 'absent presence', which describes the phenomenon of someone being physically present in one space but mentally present in another.

Cooper (2002) asserts that the private 'is no longer conceivable as what goes on, discreetly, in the life of the individual away from the public domain, or as subsequently represented in individual consciousness' (quoted by Traxler 2007b, p. 260): in short, mobile technologies require a re-definition of what is private, what is public and what is intimate.

The educational establishment, we would posit, has yet to start to consider the implications – good or bad – of these fundamental changes.

Learner-Generated Contexts

One defining characteristic of mobile technologies is their potential, or affordance – a term widely used in the specialist literature, if contested by some commentators (see e.g. Oliver 2005; Chapter 3), who note, for example, that the concept tends to negate the wider context of the objects in question as well as their culture of use, i.e. for users to create contexts for learning. We use the terms 'affordance' deliberately in this book, as we do not subscribe to the view that the concept negates the wider context nor inhibits cultures of use. Instead, as we show in Chapter 7, we take the view that the potential and constraints of mobile devices, e.g. in terms of their functionality, whilst not determining them, nevertheless have a bearing on the actions that are possible with and around them, e.g. by constraining or fostering what meaning-making is possible in the context of their use. With reference to

Weilenmann (2003), Stald (2008, p. 145) stresses that mobile technologies do not make users independent of place, which she argues remains important because users are constantly negotiating their mutual understanding of the situations in which they find themselves. However, we would argue that mobile devices for example increase the students' ability to bring into fruitful synergy the knowledge distributed across communities of use. As such, using Vahey, Roschelle and Tatar's terms (2007), they make it possible for private cognition and public interaction to be and become linked. Most relevant for our line of argument in this book is the realisation that learning, understood broadly as meaning-making, is always situated (see e.g. Lave and Wenger 1991) and that even if movement in geographical space is foregrounded, meaning-making is still situated in contexts and situations, albeit in all probability ones that transcend specific geographical places and physical spaces.

In the literature about social networking and mobile learning, the notion of space is frequently discussed, within which, it is argued, the use of (mobile) devices and attendant learning processes have to be understood. (see e.g. Crook and Harrison 2008)

Sharples et al. (2008), for example, distinguish the following spheres of and for mobility: mobility in physical space, mobility of technology, mobility in conceptual space and mobility in social space. They also note the fact that learning is dispersed in time.

Kevin Walker, in his attempt to map the landscape of mobile learning (2007, p. 5), rightly notes that one of the defining characteristics is learning across contexts.

Matt Locke (<http://www.test.org.uk/2007/08/10/six-spaces-of-social-media>), in a blog posting in October 2007, distinguishes the following six 'spaces' of social media with examples:

- secret spaces (SMS, MMS, IM),
- group spaces (Facebook, Myspace, Bebo),
- publishing spaces (Blogger, Flickr, YouTube),
- performing spaces (Second Life, World of Warcraft),
- participation spaces (Meetup, Twitter) and
- watching spaces (mobile tv).

Locke does note some of the limitations of this conceptualisation, in particular the overlap between some of the categories as well as their existence offline as well as online. The particular appeal of this model, for our purposes, lies in its user- rather than platform- or application-centredness. In view of our earlier discussion, one might question the appropriacy of a term like 'secret'. One important weakness of Locke's conceptualisation for us, however, lies in the lack of clarity of the use of the term 'space', in particular with reference to our socio-cultural ecological approach as in our terminology what Locke lists are structures through which users generate contexts for meaning-making.

Luckin et al. (2005, pp. 1, 3–5) consider one of the advantages of mobile technologies to lie in their ability to overcome the constraints of specific educational cultures within which technology is used by enabling the linking of learners' experiences across multiple locations. Indeed, Rose Luckin and her group, the Learner Generated Context Group (http://en.wikipedia.org/wiki/Learner_generated_context) was one of the first to use the notion of user-generated

context. They posit that context has both a static and a dynamic dimension. The static elements of content ('the stuff to be learnt'), process ('ways that stuff can be learnt') and place ('where stuff can be learnt'), they argue, interact with each other dynamically. In their paper, they identify the following 'linkages' (pp. 12–13) afforded by mobile technologies: linking learner to people, learner to knowledge, learner to knowledge and location, learner to location and its organization and people to people. In their final analysis (p. 19), they see the role of technology as 'helping to identify ways in which resources can be adapted to meet the needs of a learner rather than as a tool that can adapt itself to the context and to the learner'. And, 'it must be used as a means to provide continuity across locations'. If nothing else, Luckin et al.'s discussion reminds us of the importance of context in learning.

Hung and Chen (2007, p. 148) stress the importance of authenticity of and across context(s) and argue for the authenticity of practices, i.e. for the likening of learner actions with practitioner actions. They also foreground the issue of what they call 'identity enculturation' arguing that (learning) communities and domains are bounded by certain beliefs, attitudes, norms and roles, including epistemological orientations towards knowledge, which all have a bearing on identity construction and re-constructions as learners move between diverse communities.

Dourish (2004), in a conceptual piece which acknowledges the centrality of context, attempts to move beyond a view of context as being located in positivist, phenomenological and critical theory considerations. Instead of viewing context as a representational problem, he puts forward a view of context as an interactional problem. Dourish bases this view on four assumptions (p. 5): contextuality is a relational property that holds between objects and activities; the scope of contextual features is defined dynamically; context is particular to each occasion of activity or action; and context arises from the activity, it is actively produced, maintained and enacted in the course of the activity in hand. He raises a fundamental question which, we feel, is of central importance to an understanding of the potential of mobile technologies in learning: 'how and why, in the course of their interactions, do people achieve and maintain a mutual understanding of the context for their actions?' (p. 6) In his thinking, 'context isn't something that describes a setting; it's something that people do. It is an achievement, rather than an observation; an outcome, rather than a premise'. 'Context cannot be a stable, external description of the setting in which activity arises. Instead, it arises from and is sustained by the activity itself'. In other words, how, why and with whom mobile technologies are used become more constituent of context than is where and when they are used.

On a practical level, Dourish's interactional view of context is borne out by work carried out in Finland on the active construction of experiences through mobile media. In their study, Jacucci et al. (2007) focus on the role of technology-mediated memories in constructing experiences. They observed that users expended cognitive, social and physical resources supported by mobile technologies, particular the camera function of mobile/cell phones, to foster continuity and group identity, to reflect on the self and/in relation to the group. The study identifies a number of multimedia-mediated forms of expression, in particular: staging, competition, storytelling, joking, communicating presence and portraying others. The study is

not only of interest in relation to our discussion of learner-generated contexts, but also because of its detailed discussion of the role of memory in the creation of experiences and, therefore, the process of learning. It posits that memory is an active and proactive participant in the process of producing acts of volition, and that it is not just a storage device for experiences and events in the past (p. 3). And, it raises the question of how mobile technologies, in particular multimedia devices, can be used prosthetically to support the recording of experiences as well as the active construction of experiences and actions. In the same way Dourish sees contexts as embodied, Jacucci et al. see meaning as emergent and not predetermined in events (p. 5). Ubiquitous multimedia, they argue 'could have an explicitly participative role enhancing, and thus shaping experiences by taking part in the emergence of meaning supporting shared interpretation, or assisting doing and undergoing'. Their work, we would posit, supports our view on 'affordances' in so far as it exemplifies the fostering role of mobile devices, in this instance multi-media functionality, in contexts of interpersonal communication in the process of meaning-making. And, the example demonstrates the capability of mobile devices to produce cultural resources that are significant in identity formation.

We believe in the importance of the situatedness of activities carried out with the help of mobile technologies – in our case for purposes of learning. We consider the spatial framing for learning, be it real or virtual, as less important. Instead, we consider the importance of situatedness to lie in the framing it provides for meaning-making. Very important in this context is for us the notion of agency, namely the creation by the user/learner together with other relevant parties, such as teachers and peers, of situations conducive to the use of mobile technologies as frames for meaning making. Like Dourish, we believe in the importance of practice, i.e. people's engagement with particular settings, in which context becomes 'embodied interaction' (p. 14).

Augmented Reality

Another important affordance of mobile technology for us is digital augmentation whereby contextual data is added to objects to enable a deeper understanding of them and richer meaning-making. Digital augmentation is particularly relevant for user-generated contexts, for example the provision of multimedia data about real objects or places through GPS. The data can be drawn from third parties but can also come from users themselves. In the literature the term 'ambient learning' is sometimes used to express the potential of digital augmentation, which is bound to grow significantly in the coming years with physical spaces and objects becoming increasingly 'learning-enabled' with the growth of wireless networks and the continuing fall in prices for associated technologies. Some useful examples of the use of digital augmentation to foster learning can be found in Price (2007) and Rogers and Price (2007). An interesting perspective on things to come is offered by theoretical physicist Michio Kaku in a 2008 programme in the BBC Four series entitled *Visions of the Future* in which he predicts an

intelligence revolution in which artificial intelligence will become ubiquitous (see <http://www.bbc.co.uk/bbcfour/documentaries/features/visions-future.shtml>).

Affective and Motivational Factors

The high levels of intrinsic motivation normally associated with technologies make ICT an attractive proposition to educators. The levels of intrinsic motivation do decrease as technologies lose their novelty and are replaced by newer devices and greater functionality. This problem of hardware and software becoming constantly out of date poses a real challenge and has been referred to as ‘dynamic obsolescence’ (Davies 1997). However, the fact that ownership of mobile devices by the learner is statistically more likely than of desk-based ones, as well as because of the possibility, for the first time ever, of a 1:1 student-device ratio, motivation engendered by mobile devices can be higher and more sustained. Intrinsic motivation can also be pedagogically enhanced by the provision of challenge and complexity as well as curiosity in the design and choice of activities and tasks that allow for agency by the user. One effect that tends to remain strong, though, given the predominantly technophile orientation of modern society, is a high level of face validity of technological devices, which can be counter-productive in educational contexts, as it can create tensions in relation to the pedagogical leadership role of educators in the use of new technologies for learning.

Jones et al. (2007) posit that affective factors play a strong role in harnessing technology for learning and list six reasons why users find mobile devices particularly engaging: control over goals, ownership, fun, communication, learning-in-context and continuity between contexts (p. 18). Naismith and Corlett (2006), in their reflections on the successes of mobile learning assert motivational benefit inside and outside the classroom as well as high levels of engagement in learning activities and learners’ environments. Peters (2007, pp. 3–4) identifies a number of ‘unique educational affordances’ of mobile devices, such as portability, social interactivity, context sensitivity, connectivity and individuality, which can all be seen as linked to intrinsic motivation for learners and their teachers. Studies about mobile technologies in use, for example that by Stald (2008), often stress the importance of mobile technologies, in particular mobile/cell phones, in establishing social belonging and norms and, in particular for young people, in relation to questions of identity and their place in their peer group:

The mobile has become the ideal tool to deal with the pace of information exchange, the management of countless loose, close or intimate relations, the co-ordination of ever-changing daily activities, and the insecurity of everyday life. Hence the mobile becomes a learning tool for dealing with living conditions in modern society for young people, while at the same time it adds to the conditions they are trying to deal with. (Stald 2008, p. 144)

Evidence suggests (Stald 2008, pp. 149–150, 155) that adoption and appropriation of mobile technologies, loosely defined here with reference to Waycott (2004)

as their routine usage for and integration into users' activities but not always necessarily for the purposes and in the ways envisaged by designers and service providers, are not only determined by practical issues such as availability, usability, functionality or infrastructure but also by socio-cultural factors, such as perceived need and trends. The socio-cultural dimension is particularly important as with the growth in social networking tools and applications, communication mediated by (mobile) technology is particularly prevalent with people from one's everyday life-world. And the mobile/cell phone can play an important role either in fostering a sense of co-presence, nearness and intimacy or it may be perceived as an alienating medium. Berson and Berson (2007, p. 291) note the importance of mobile/cell phones in shifting power dynamics between adults and young people: 'home and school have traditionally been adult-dominated spaces in which communication with peers was regulated by parents or teachers'.

Importantly also with respect to affective factors, mobile telephones can be viewed as a 'mobile extension of the body and mind' (Stald 2008, p. 158) with the devices always being in close proximity to the body. Interestingly, Stald asserts that the physical device holds no or little affective value but, instead, that it is primarily the content and the representations it contains that matters. This is not a view espoused by Berson and Berson (2007, p. 291) who argue that the physical object of the mobile/cell phone has social value and that characteristics of the device have become important status symbols. They believe that 'the device functions as a symbol of young people's connections with, and membership in, their peer group'. Stald also argues that the phones themselves are more like conduits for affective and social bonds between people than substitutes for them. This does not entirely tally with our own work (Cook et al. 2008) where ownership and the 'coolness' of a device appear to matter affectively to users. Stald does concede, though, that there tends to exist a certain degree of identification, which extends to the actual mobile/cell phone number as codes for intimate and social relations and access to networks.

Interface Between Learning in Informal and Formal Settings

One question we consider to be of great importance in relation to mobile devices is their potential to overcome the, in our view, unhelpful conceptual division between 'formal' and 'informal' learning. As we have shown in Chapter 1, the terms suggest differences in the processes attendant to learning, where, in our view, the differences pertain mostly to the sites of learning. We consider the socio-cultural practices developing around the use of mobile devices as a real opportunity for legitimising learning outside formalised educational frames, normally referred to as 'informal learning', and to validate them.

This issue of interface does emerge from our review of the literature. One important dimension of the attempt to overcome current conceptual and actual barriers is an effective technological infrastructure, which allows for the seamless transfer of artefacts from one context to the other. Another is the increasing embeddedness of information, and people online, which Breck (2007, pp. 52, 53) describes

as ‘viral’ and ‘intertwined’, by which she means a relationship characterised by a certain lack of hierarchy, categorization and sequentiality. From a conceptual and theoretical perspective this not only raises epistemological questions about what constitutes knowledge, but also ontological questions around conceptions of reality. Brodie, in his foreword to Fensel’s book on ontologies as the solution for knowledge management and electronic commerce (2004, p. vi), defines an ontology as ‘a community-mediated and accepted description of the kinds of entities that are in a domain of discourse and how they are related. They provide meaning, organization, taxonomy, agreement, common understanding, vocabulary, and a connection to the “real world”’. It is clearly much more difficult to achieve agreement of this kind in the context of an ever more spatially distributed group of users and learners.

One key component of such an infrastructure, in addition to ownership of appropriate interoperable mobile devices with affordable connectivity, is a learning object repository which allows for the easy storing, retrieving and re-using of dynamically created digital artefacts. According to Verdejo et al. (2007, 44–45), searchability enhanced by appropriate metadata is one key characteristic of an effective repository. Others, it is argued, are heterogeneity – the possibility of storing objects from a variety of resources –, automatic and contextual metadata generation, a community portal as well as the ability to synchronise distributed repositories in a network.

We argue here that the interface between sites for learning can also be greatly facilitated by some degree of meta-level awareness of the learner about the learning processes they engage in across spaces, time and sites of learning. The same can be said of purposefully designed learning networks and paths (see Koper et al. 2005). One possible model is that developed by Schenker et al. (2007, p. 172), who describe three interacting domains: external representations of knowledge, individuals’ internal conceptualizations of knowledge, and the social uses made of knowledge and through which it is constructed. Arguably the navigation across sites of learning is much easier if they are not viewed as opposing poles but rather as a continuum which invariably, and irrespective of where along the continuum one is positioned, is about a purposeful engagement with Schenker et al.’s three interacting domains rather than temporal or spatial positioning. The fundamental role for the educator is to consider how best to use technology, in our case mobile devices, to affect the engagement with these domains.

And, we posit that a learner-focussed locus of control and learner agency are key in ensuring the gap between learning in formal and informal settings can be successfully bridged.

Mobile Learning and Design Issues

Simply given the physical characteristics of mobile tools, such as their small size and portability and, therefore, the size of the screen and keyboard/input device, i.e. due to usability and accessibility issues, as well as the contexts within which they are being used, characterised at times for example by bad lighting, background noise

or other types of interference, the issues attendant to design are not insignificant. In order to pack a high number of functions into a small device, great attention is required to the physical design of the handset as well as the graphical interface of the software applications running on the devices themselves. And, the size of the display requires careful packaging and chunking of content. Of late an increase in the number of mobile devices is discernible that have been specifically designed with educational use in mind, such as Ultra-Mobile PCs (UMPCs) and NetBooks.

The design of tools, including the software, is fundamentally predicated on the envisaged types of use. For example, in a conversation-based framework (see e.g. Laurillard 2007; Sharples et al. 2007), where mobile devices are viewed as tools for harnessing conversations between learners and learners and between learners and educators, connectivity for synchronous and asynchronous communication become very important with an emphasis on facilitation, rather than impeding or interference through distracting attention from the content to the process, for example by adhering to the 20 second interaction principle whereby it needs to be possible to complete all logical steps from start to finish of a task within 20 second (Jacucci et al. 2007, p. 29). Jacucci et al. posit that even 20 second is often too long, which renders a service useless. Therefore, devices need to be easy to use and the process of learning how to use them needs to be intuitive and straightforward. Norris et al. (2007, p. 6), with reference to Moore (1991), use the metaphor of the need for mobile technologies to 'cross the chasm' from being niche products to becoming an integral part of the consumer mass market. And they consider design considerations to be crucial in the transition to ensure that the needs of mainstream users, as opposed to early adopters, are catered for. Norris et al. (2007, p. 7) argue that unlike early adopters, who tend to find new technology intrinsically interesting and who are willing to devise workarounds for any shortcomings, mainstream education practitioners are mainly concerned with the curriculum and its 'delivery' and they tend to see technology as a means to an end. One hopes that they are also concerned with processes of learning. Norris et al. also suggest that mainstream teachers are looking for simplicity and reliability rather than viewing technology as new opportunities.

The attentional aspect is also foregrounded by Beale (2007a, p. 14) who notes that, particularly when working in new, and often uncontrolled environments, in which greater situational awareness and alertness is needed than normally, 'having to change a focus of attention from the 'real world' to a specific device can be problematic'.

Design issues are, of course, also very pertinent in relation to the integration of mobile devices into, and interoperability with teaching and learning processes and curricula, as well as the infrastructure for learning provided by educational institutions. Hoppe (2007, p. 33) distinguishes the following types of integration: media, process and knowledge.

O'Connell and Smith produced a very helpful manual for and guide to working with mobile learning standards published by the Australian Flexible Learning Framework in 2007. They draw on the work of the e-learning consortium at the Masie Centre NY which had outlined six 'abilities' that define standards in e-learning:

- interoperability (*ability of two or more systems to share information*)
- reusability (*ability to reuse or modify existing systems, data or code*)
- manageability (*ability to monitor and maintain systems, data or code*)
- durability (*ability of a system to endure over time*)
- scalability (*ability of a system to handle growing amounts of information and work*) and
- affordability (*ability of systems and data to remain in financial reach of users*). (O'Connell and Smith 2007, pp. 3–4)

These 'abilities' are considered to be of relevance for mobile learning design as well. The authors also advise their readers to ensure resources are cross-compatible with baseline delivery contexts, to exploit the capabilities of specific devices to maximise quality and usability as well as to exploit the creation capacity (p. 8). The latter point, i.e. the harnessing of the potential for knowledge creation by users, is also made strongly by Bruns (2007) who has coined the term 'produser' describing the ad hoc, on-the-fly user-and-producer position of learners. Bruns sees the difference between a user and a producer model as one of quantity as well as quality of participation.

And, of course, design issues also come into play in relation to the production processes teachers and learners themselves engage in when creating content for and with their mobile devices. For effective use in everyday situations or the hurly-burly of a classroom, features such as instant-on/instant-off are very important as without them the ephemerality of the here and now cannot easily be captured, even using mobile devices. With reference to the design of innovative educational activities, Milrad (2007, p. 30) suggest 'scenario-based design' which is thought to offer a rich description of the interactions of the settings, actors, goals/objectives, actions and events constituting a scenario. Of real significance here for us are the multimodal affordances and characteristics of mobile devices, in particular how images and sound-related functionality impact on both the input and output dimensions of interactions as well as the representation of information and knowledge.

Naismith and Corlett (2006, pp. 19–20), reviewing papers presented at *mLearn* conferences between 2002 and 2005, identify the following design principles:

- create quick, simple interactions;
- prepare materials that are flexible and can play to the heterogeneity of learners and situations;
- design access and interactions that account for the heterogeneity of devices and standards;
- consider the affordances and limitations of the devices;
- focus not only on delivery of content but also on facilitation of learning;
- apply a learner-centred design in view of the lack of fit of teacher-centred models with a diverse range of learning environments.

All of the above, clearly points towards the need for a theory of instructional design for mobile learning which, as Sharples et al. (2008) rightly note, has not yet been fully articulated. Our experience also suggests the need for an iterative approach to the design of artefacts, such as re-usable learning objects (RLOs), which

is linked synergistically to theorising (Bradley, Haynes, Cook, Boyle and Smith, 2009). And Divitini and Morken (2007, p. 12), quoting Thackara (2005) suggest the need to design for ‘new geographies of learning’ by which they mean ‘configurations of space, place, and network that respect the social and collaborative nature of learning – while still exploiting the dynamic potential of networked collaboration’. They point out that collaborative learning is increasingly taking place within and across looser communities (p. 13), which necessitates a focus on the seamless integration of different learning experiences (p. 14). Sprake (2007, p. 31) notes that mobile technologies can create conditions for ‘spatial contiguity’ and ‘spatial dispersal’ out of which ‘new’ learning webs, namely those that take in the world outside the classroom and which are characterised by lateral connections between people, objects and places, could emerge. The design of mobile learning tools, software, content and learning material needs to take account of that as well as of the needs of individual users. In order to support learning effectively, the design process needs to focus on the strength of mobile devices, such as immediacy of communication and access to information, context-sensitivity and location-awareness.

Researching Mobile Learning

Given the complexities of mobile learning delineated in this chapter, there emerges a clear need not only for sustained research into phenomena attendant to mobile learning but also for work on explanatory theoretical and conceptual frames, which enable a systematic analysis of all aspects of mobile learning. Indeed, as already noted in Chapter 1, we attempt to make a significant contribution to such an analytical frame in this book. We will discuss our deliberations in some detail in Part II of the book.

Based on the issues discussed above, it is also not difficult to imagine the challenges faced by mobile learning research. Given the (semi)private nature of much of the engagement with mobile technologies, studies are often based on the learners’ own accounts and metacognitive analyses of their learning, by means of semi-structured interviews, surveys, and diary studies with all the limitations such methods entail. Also, given the social nature of much mobile technology use around acts of communication, the challenge for researchers is not just to make tangible cognitive processes taking place within an individual, which at best manifest themselves indirectly in the creation of certain artefacts, but also how these processes are embedded in social interaction and affect, and are affected by, cognitive process of co-learners. In any event, the research methods used will invariably reflect the research questions in focus as well as the broad theoretical orientation of the researchers.

Taylor (2007, p. 28) argues that the evaluation of mobile learning best be conducted from an activity analysis point of view, from whatever theoretical perspective, which is, of course, in line with the theoretical model she espouses in her writing (Taylor et al. 2006; Sharples et al. 2007). We discuss the merits, and

limitations, of Activity Theory in some detail in Chapter 5 as a basis for our own conceptual/theoretical perspective.

Of particular importance in relation to mobile learning is also the capturing of learning over time, rather than of isolated instances, as well as of learning as context-bound; in view of the myriad of contexts within which mobile learning can take place, as well as their unpredictability, the latter issue poses a particular challenge. On the plus side, learning with and through mobile technologies leaves data trails which can be accessed and analysed by researchers. In view of the above, we see considerable merit in the use of qualitative, e.g. narrative and case-based approaches to data collection as well as data analysis. For a detailed discussion of research methods in mobile learning (see Vavoula et al. 2009).

Our attempt at a topography of mobile learning leads us to the conclusion that mobile learning can be seen as central to educational landscape of the twenty-first century. Needless to say, there is a need for more systematic research, which helps educators make informed pedagogical decisions in support of mobile learning, as well as for a sustained effort in synthesizing existing research in order to make reliable findings accessible to practitioners, researchers and policy makers (see also van't Hooft and Swan 2007, p. 350).

Mobile Learning

Structures, Agency, Practices

Pachler, N.; Bachmair, B.; Cook, J. - Kress, G. (Ed.)

2010, XXII, 382 p., Hardcover

ISBN: 978-1-4419-0584-0