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21. Conclusions: Future Directions in Researching Mobile Learning

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Overview

The purpose of this chapter is to summarise important points raised and conclusions reached by the volume's contributing authors. Their key messages converge in four areas, suggesting four generic principles that might guide future mobile learning research. The chapter also points to new directions in mobile learning research within the broader research agenda of technology enhanced learning. These indicative directions should be helpful to all involved in setting future agendas for mobile learning research and development.

1.   Introduction

As mobile learning matures and becomes integrated into formal education and informal learning, it is also in the process of developing its identity as a distinct field of research with particular concerns and challenges. As researchers, we have been reflecting on the extent to which we will continue with existing research approaches and what could be changed or developed. What can we learn from neighbouring disciplines and how can we harness new techniques and technologies, to smooth the way for our research efforts?

Most contributors to this book have remarked on the complexities and difficulties involved in researching mobile learning, based on their

experience. This echoes Naismith and Corlett's observation, that "The mLearn literature is rich with complaints about the challenges facing mobile learning" (2006, p. 17). To help understand the complexities and overcome the difficulties, our contributors have shared some insights on what they have found to be the most important aspects to focus on, what worked well or not so well, and possible reasons. Suggestions are put forward for future modifications, combinations and extensions of current methods and designs. This chapter attempts to draw together the conclusions and discussion points from research reported in the book. It then briefly considers future directions in researching mobile learning, within the broader agenda of the overarching field of technology enhanced learning. It should assist with thinking about the next stage of a current project, when planning a new piece of research, or when reviewing research undertaken or proposed by others. We aim to raise issues for ongoing discussion amongst all who have an interest in researching mobile learning, and point to directions that should be considered for future agendas in mobile learning research and development.

2.   Conclusions from research reported in the book

This section brings out some key messages from the book's contributors, covering both general reflections on mobile learning research and more specific conclusions and recommendations. Good frameworks and methods exist for well-defined evaluations, for analysing mobile device appropriation and for studying informal learning, as discussed in the chapter by Sharples. The considerable success of current methods is evidenced by work such as that on learner activity tracking undertaken by Mayr et al., Trinder et al., and Wali et al., reported in this book. Here, we concentrate on researchers' reflections on their experience, especially where these reflections point to new directions with regard to emphasis, method, or who should be involved in research.

Overall, the authors' key messages converge in four areas, suggesting four generic principles that could guide future mobile learning research, which are elaborated below. Please note that since the remainder of this section constitutes a summary, the wording used here is not always exactly that of the authors even though authors' names are attached to particular statements. Readers are advised to read the relevant chapters to ensure a full understanding of an author's position.

2.1   Research should be in tune with new thinking about learning

Mobile learning is a different way of learning that changes the nature of what is learnt, where and how, chiefly by its capacities to take advantage of a learner's specific location and moments of heightened motivation. It frequently foregrounds the social nature of learning and societal implications. As mobile learning researchers we investigate this, but we also have a role in making the learning explicit and ensuring that our designs and methods are not at odds with the essential ethos of mobile learning. The following authors advocate aligning research with aspects of new thinking about learning:

- What is the implicit ethos of mobile learning, and how does it match up to the philosophy of its research and evaluation methods? Few evaluations use techniques and tools indigenous to mobile learning (Traxler)

- Informal activities place different demands on evaluating learning outcomes and require different approaches to designing learning: e.g. mobile communities, expertise on demand (Spikol)

- We should not reify learning by identifying it with frequent use of computers or other tools. Reflective learning is central to our lives. Measures of learning via tools or tests are inevitably limited (Livingstone)

- In museum learning, the learning agenda is set by the user reflecting their motivations and interests and not by an institution. Sometimes there are unexpected learning outcomes (Dodd)

- Take a closer look at process rather than product of learning (Van't Hooft)

- Today's networked society embodies a mindset based on expertise and authority that is open, collective and distributed, rather than housed in closed systems, individuals and institutions (Pierroux)

- Shift attention from technology as a tool to seeing it as a site that shapes social practices and identities (Ros i Solé)

- Both human factors and social-cultural perspectives are important elements to consider when evaluating mobile learning (Mwanza-Simwami)

- Research should be personalized yet collaborative (Van't Hooft)

- Research needs to become more agile; Research 2.0 can mirror Web 2.0 (McAndrew, Godwin and Santos)

What is different about teaching and learning, when mobile technology is used? What can be discovered about learning, and will it change perspectives in the discipline? Several authors recommend a focus on change:

- *History*: How does teaching and learning of history change when learning while mobile? (Van't Hooft)

- *Mathematics*: Probe into the nature of mathematical thinking and learning in context; boundary objects increase visibility of what learners do and do not understand, help learners to externalize it (Kent)

- *Astronomy*: personal meaning mapping can capture knowledge acquired during a museum visit, which might not have been identified by traditional tests (Lelliott)

- *Language learning*: Challenge current conceptions of language learning: focus on social habits and the sense of the language learning self; change perspective on what counts as communication (Ros i Solé)

2.2   Research should consider the impact of context

Mobile learning research involves studying activities that take place across multiple formal and informal settings. Authors' general reflections on context and specific recommendations on context and method include the following:

- Context is not fixed, activity can span formal and informal settings, it can spread over long periods of time; therefore methods need to be sensitive to time and context (Sharples)

- There is a need to communicate use genres that cross boundaries of public and private spaces, bound up with learners' life worlds which are inconspicuous (Pachler, Cook and Bradley)

- It is challenging to gather data from real-world learning (Kramer); activity-oriented design methods characterise the messiness of real world practices in a way that is valuable to others (Mwanza-Simwami)

- Large amounts of longitudinal data are needed to reflect on continuity of activities in multiple contexts (Wali, Oliver and Winters)

- Collect data about physical and social context (Wali, Oliver and Winters)

- Look at continuous engagement with linguistic activity in a variety of contexts [for language learning] (Ros i Solé)

- Where different social worlds intersect, boundary objects can mediate negotiation (Kent)

2.3 Research should consider different types of data and analysis

As implied by the variety of contexts involved in mobile learning, and to ensure validity, mobile learning research needs to make use of several sources and types of data and adopt appropriate methods of analysis. Authors have mentioned that multiple technologies already make it difficult to capture evidence of learning. Being aware of the totality of a learner's environment and range of learning tools will become ever more important:

- There is a need to look at different types of data – spatial, temporal, learner, etc. – and analyse it for patterns (Van't Hooft)

- Traditional qualitative data collection can be supplemented with an electronic mobile diary system (Dearnley and Walker)

- Different sources of data are needed to triangulate self reports: learners' self reports may not be consistent with their mobile learning practices (Wali, Oliver and Winters)

- Automatic logging may be influenced by group dynamics; multiple sources of information are needed for analysis (Trinder, Roy and Magill)

- Narrative approaches to data collection and analysis may help to draw out meaning from different sources (Pachler, Cook and Bradley)

- Researching informal learning could mean using a mixture of tracking, simplified surveys and gathering interesting stories (McAndrew, Godwin and Santos)

- Take note of personal meaning, e.g. in informal learning in museums (Lelliott)

- Mobile eye tracking gives insights into cognitive processing; combine eye tracking with other methods, to increase validity. Could combine eye tracking with Personal Meaning Mapping (Mayr, Knipfer and Wessel)

- For an immediate record of experience, Personal Meaning Mapping could be made available on mobile devices (Lelliott)

- Automated analysis of video data is needed (Mayr, Knipfer and Wessel)

- Ethnographic methods and analyses are valuable for learning research, whilst interactional data is valuable for design research (Pierroux)

2.4 Research should involve learners as co-designers or co-researchers

Learners will be a key source of data in mobile learning research, but it is also becoming more common to involve them more closely in the design of learning, and the design and execution of research, as endorsed by several authors:

- Place learners at the centre of research and design, using scenarios. Other emerging methods include simulations and enactments (Kramer)

- Engage learners in discussions about possible uses and attendant barriers (Pachler, Cook and Bradley)

- Gather rich data from learner's perspective (Mayr, Knipfer and Wessel)

- Collaborative co-designing and co-teaching can encourage an organization to take control of what begins as researcher-led intervention (Kent)

- Participatory research design can shift locus of control in data collection processes (Dearnley and Walker)

- Co-design practices have been used for mobile games to support learning. Involving children in the design process may give us new perspectives on the nature of their learning practices and address new literacies (Spikol)

- Encourage all to be part of the experiment. Extending an invitation to all involved, end-users and producers, will help maximise value and enable routes to get extra information (McAndrew, Godwin and Santos)

- Personal meaning mapping could be successful because it requires no prior experience on the part of learners (Lelliott)

- A future technology workshop approach (Vavoula and Sharples, 2007) would be appropriate for allowing participants to explore ideas for new technologies more creatively (Pierroux)

Involving learners is not necessarily easy, as noted by Trinder, Roy and Magill with regard to activity logging. Van't Hooft suggests that data collection should go unnoticed by the learner; otherwise there is a risk of interfering with the learning experience. Ethical concerns are raised by several authors, e.g. the issues raised by installing system-monitoring software on students' laptops (Wali, Oliver and Winters). An ethical procedure is suggested by Mayr, Knipfer and Wessel.

The remaining part of this chapter addresses new directions in researching mobile learning within the broader research agenda of technology enhanced learning. These will be relevant to future agendas in mobile learning research and development.

3.   The future of technology enhanced learning

Mobile learning shares many of the concerns of the broader field of Technology Enhanced Learning (TEL) and its focus on defining the role of technology in learning, for example in relation to the social networking ethos of Web 2.0. Conole (2008) argues that there appears to be "an irresolvable tension between current educational practice which is essentially individualistic and objective, and the philosophies inherent in Web 2.0 – namely social and subjective" (¶9); however she goes on to say that in actual fact "there has never been a closer alignment between the current practices of Web 2.0 technologies and what is put forward as good pedagogy – what we need are means to realise and harness this match" (¶10). This implies thinking about pedagogical theories (e.g. social constructivism, situated learning) and how they map to technologies, as well as identifying practices that educators may wish to promote (e.g. reflection, interaction).

The field of technology enhanced learning is currently characterized by attempts to reconcile teacher-led learning with the opportunities created by technology to hand over more control to learners. Writing about new horizons in learning design, Ravenscroft and Crook (2007) recommend starting from "the learner's own devices, preferences and behaviours", to design "meaningful and relevant interactions for a generation of technology-enabled learners" (p. 213).

Researchers who contributed to a Kaleidoscope Network of Excellence collective working paper on the future of TEL (Balacheff, 2006) declared the need for a research programme combining collaborative, mobile and inquiry learning, with a view to questioning underlying concepts and theoretical frameworks. This programme should develop a new ecology of learning, with models accounting for learning as an emergent process and models of "context-as-construct". They note that organizational, economic and socio-institutional issues play a vital role in the research agenda and conclude that "the complex process of adoption of TEL in the different learning contexts is at the centre of where we should concentrate research efforts in the future" (p. 6). This can be taken as a helpful reminder that even an apparently successful mobile learning implementation will need to concern itself will researching issues of adoption.

The standard textbook by Cohen et al. (2005) gives a helpful general framework for planning research in education, starting with strategic decisions such as "Who wants the research?", "Who owns it?", through to decisions about research design and methodology, to data analysis and the presentation and reporting of results. As is typical of research in the social sciences, many questions and decisions revolve around human participants and stakeholders. As soon as information technology is used in education, the focus shifts to the intersection of human learning and the use of technology, generating new questions around interrelationships between the

two. A strong focus on technology can mean that the human dimension gets relegated to second place. To bring learners' views to the fore, Conole et al. (2006) have used audio blogs successfully in the LearnerXP project, for in-situ, emotive diaries giving a real flavour of learner experience with technology. The human dimension should always remain at the centre of research in learning, and this continues to be true for mobile learning (Kukulska-Hulme, 2008).

4. Future research in mobile learning

As is evident from all contributions to this book, mobile technology has intensified the need to cultivate awareness of the social and cultural dimensions of learning and it has put a spotlight on "context". Laurillard (2007) reaffirms the importance of context, combined with motivation, when she writes that mobile technologies "offer digitally-facilitated site-specific learning, which is motivating because of the degree of ownership and control" (p. 157). From her perspective, important research questions for mobile learning concern pedagogic forms that fully support the learning process and exploit the richness of a remote environment, and best ways for teachers to construct such remote environments for learning.

Giving due attention to learners, teachers, technologies and contexts, in all their complexities, will never be easy. This is set to increase as learning technology becomes ubiquitous. Naismith and Corlett's (2006) retrospective on the mLearn conference series (2002–5) lists several positive outcomes of successful projects, and points to a number of critical success factors for mobile learning, namely: availability of technology, institutional support, connectivity, integration and ownership. These outcomes and factors should be considered in mobile learning evaluation, but they will need to be reviewed and updated as the field develops.

As noted by Huang et al. (2008) who have developed a system for synchronous mobile learning with context-awareness, in a fully ubiquitous learning environment there will be additional challenges, since the context includes "ambient objects, such as available services, locations, peers, resources, states of learners, and so on" (Huang et al., 2008: 1221). Human-computer interaction researchers are developing tools and methodologies that use elements of context, for example Intille et al. (2003) developed a PocketPC tool for context-aware "experience sampling" that uses sensors to detect a person's location and combines it with other data to trigger appropriate questions about the user's experience. To understand situated social interactions, Paay and Kjeldskov (2007) have carried out a study of social experience of a physical space in a city centre, using "rapid ethnography" as a method. This will inform development of mobile services for fostering social connections in public places. Again from the field of human-computer (or computer-human) interaction, Hagen et al. (2005) consider that "more technologically sophisticated and contextually appropriate ways for participants to provide their own field data is an emerging area in mobile research methods" (p. 8), along with "mediated data collection" methods where access to data about actual use practices is mediated by both participants and technology. The probable convergence of mobile learning and research on informal mobile-supported social interactions in public spaces will require even closer collaboration between experts in mobile learning and in human-computer interaction research.

As mobile learning is fast becoming a global phenomenon, it is also necessary to bear in mind that "western" research approaches and methods are not always relevant and appropriate when studying mobile learning in other parts of the world. Papoutsaki (2006) has argued for the "de-westernisation" of research methodologies for education research in developing countries, to take account of alternative ways of learning and distinctive understandings of local knowledge. Such alternative perspectives can enrich our conceptions of context and may eventually lead to improved ways of researching mobile learning.

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