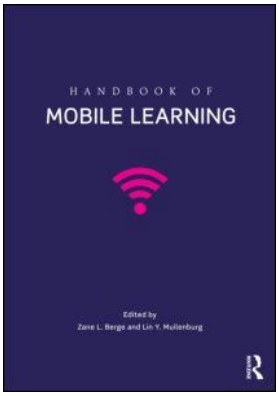

Handbook of Mobile Learning

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A Summary and Critique of M-Learning Research and Practice

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A SUMMARY AND CRITIQUE OF M-LEARNING RESEARCH AND PRACTICE

Thomas Cochrane

In their summary of the scope of m-learning research, Traxler and Kukulska-Hulme's (2006) main critique of these early m-learning research projects was for a general lack of rigor in evaluation and epistemological underpinnings.

> M-learning is at a leading edge of learning technologies and is at present characterized by pilots and trials that allow mobile technologies to be tested out in a variety of learning contexts. The sustained deployment of m-learning will depend on these pilots and trials, especially their evaluation methodology and reporting. The majority of pilots and trials in our samples had no apparent epistemological or educational foundations
>
> (Traxler & Kukulska-Hulme, 2006, p. 143, 148).

OVERVIEW OF M-LEARNING RESEARCH

This section briefly overviews a short history and critique of m-learning research, indicating the research gaps within the context of current m-learning activity. The scope of the chapter is limited by its necessary briefness, and focuses upon several broad themes.

Phases of M-Learning Research

The 21st century has seen the consolidation and maturing of m-learning research (Traxler, 2008). Internationally, many early (pre-2005) m-learning studies were typically short-term pilot studies. M-learning research now spans the globe: for example, Africa (Vosloo, Walton, & Deumert, 2009), Asia (Ogata et al., 2010), North America (Metcalf, 2006), Europe (Seta et al., 2010; Unterfrauner & Marschalek, 2010), Scandinavia (Laine & Suhonen, 2008), Australia (J. Herrington, Herrington, Mantei, Olney, & Ferry, 2009; Litchfield, Dyson, Lawrence, & Zmijewska, 2007), and New Zealand (Chan, 2007; Cochrane, 2011).

According to Cook (2009a) and Sharples (2010), the development of m-learning research has been characterized by three general phases:

1. a focus upon devices (for example: handheld computers in schools (Perry, 2003));
2. a focus on learning outside the classroom (for example: MOBILearn (O'Malley et al., 2005));
3. a focus on the mobility of the learner (for example: MyArtSpace (Sharples, Lonsdale, Meek, Rudman, & Vavoula, 2007), CONTSENS (Cook, 2010)).

Since 2005, there has been a flurry of m-learning research and case studies, particularly from the United Kingdom (UK). M-learning and Web 2.0 technologies have been identified as emerging tools to enhance teaching and learning (Anderson, 2007; Becta, 2007; Johnson, Levine, & Smith, 2007, 2008, 2009; McFarlane, Roche, & Triggs, 2007; McLoughlin & Lee, 2008; Sharples, Milrad, Arnedillo-Sanchez, & Vavoula, 2009; Traxler, 2007; Trinder, Guiller, Marggaryan, Littlejohn, & Nicol, 2008), but are not usually explicitly linked together. The following all demonstrate an increase in mainstream interest in m-learning: the increase in m-learning-focused conferences (for example: MLearn, Handheld Learning, Multimedia and Information and Communication Technologies in Education, the International Association for Development of the Information Society m-learning conference, Wireless Mobile and Ubiquitous Technologies in Education); research projects and briefing papers from organizations such as the Joint Information Systems Committee (JISC) and the British Educational Communications and Technology Agency (Becta); articles in educational journals such as *Educause* and the *Journal of Computer Assisted Learning*; the establishment of several m-learning-focused journals (for example: *International Journal of Mobile Learning and Organization*, *International Journal of Mobile and Blended Learning*, *International Journal of Handheld Computing Research*); and books (Ally, 2009; Metcalf, 2006; Pachler, Bachmair, & Cook, 2010; Ryu & Parsons, 2009; Woodill, 2010).

M-Learning Research Approaches

Approaches to m-learning vary from a focus upon content delivery (McKinney, Dyck, & Luber, 2009), short message service (SMS) (Mellow, 2005), polling (Dyson, Litchfield, Lawrence, Raban, & Leijdekkers, 2009), and location awareness (EDUCAUSE Learning Initiative, 2009; Pachler et al., 2010), to facilitating student-generated-content sharing (Sharples, et al., 2007) and augmented reality (Priestnall, Brown, Sharples, & Polmear, 2009; Sharples, 2009). In their review of 102 innovative m-learning projects published between 2002 and 2007, Frohberg, Goth, and Schwabe (2009) found that only 5 percent of these projects focused upon social learning, and less than 4 percent required higher-level thinking, with 89 percent targeting novice learners and 10 percent facilitating user-generated content. Many m-learning studies focus upon content delivery for small-screen devices (Stead & Colley, 2008) and the PDA capabilities of mobile devices (Corlett, Sharples, Bull, & Chan, 2005), rather than leveraging the potential of mobile devices for collaborative learning, as recommended by Hoppe, Joiner, Milrad and Sharples (2003):

> Content delivery to mobile devices may well have a useful place in m-learning, however, there is an imperative to move from a view of e- and m-learning as solely delivery mechanisms for content . . . Handheld devices are emerging as one of the most promising technologies for supporting learning and particularly collaborative learning scenarios.
>
> (Hoppe et al., 2003, p. 1)

Informal m-learning case studies in museum-tour environments have been popularized by the work of Sharples, Lonsdale, et al. (2007). Other popular m-learning-project contexts include the use of podcasts (McKinney et al., 2009) or mobile devices for language learning (Thornton & Houser, 2005) and geolocation (Priestnall et al., 2009). Many recent m-learning research projects, while focusing on the informal learning environment, often presuppose "self-motivated learners" (Cook, Pachler, & Bradley, 2008, p. 4) such as pre-service teachers. Few studies have yet to explicitly bridge both the formal and informal learning contexts within "mainstream" tertiary education. One exception was the Advanced Mobile and Ubiquitous Learning Environments for Teachers and Students project (CeLeKT, 2009), which explored collaboration in a variety of contexts, bridging indoor and outdoor learning experiences using mobile and location-aware devices in both secondary and tertiary scenarios.

Large-Scale M-Learning Projects

Several larger m-learning projects have tended to focus on specific groups of learners, rather than developing pedagogical strategies for the integration of m-learning within tertiary education in general. For example, the "m-learning project" extended over four years, focusing on retention of at-risk learners by using cell-phone technologies (Attewell, 2005). The Remote Authoring of Mobile Blogs for Learning Environments m-learning project (Trafford, 2005) investigated the use of mobile devices for blogging and accessing a virtual learning environment (VLE). However, the mobile devices (Palm OS PDAs) were not wireless capable, relying upon desktop computers for synchronization to update the students' blogs. In comparison, Corlett et al. (2005) identified wireless connectivity as a key factor in the success of their implementation of an m-learning organizer. Other examples of large-scale m-learning projects include: MOBILearn (Europe; www.mobilearn.org/), MobilED (South Africa; http://mobiled.uiah.fi/), and the m-learning network MoLeNET (UK). MoLeNET is possibly the largest m-learning research project undertaken so far. MoLeNET was UK based, focused on further-education (FE) institutions, and funded by the Learning and Skills Council. In its initial phase (2007–2008), the MoLeNET project included 32 FE institutions undertaking a variety of m-learning implementations. In its third year, MoLeNET provided £12 million of funded investment in m-learning in the UK to 115 colleges and 29 schools, involving around 20,000 learners and 4,000 staff. MoLeNET funding has been directed towards wireless infrastructure and the purchase of mobile devices, and it is yet to be seen whether this approach can be sustainable or transferable to student-owned devices (Traxler, 2009, 2010) and newer mobile devices, as those purchased quickly become out of date. Many of the MoLeNET projects investigated the affordances of a variety of mobile devices loaned to students for accessing course-related content. The focus of these projects tended to be on the delivery of content for access on a range of mobile devices. As such, the MoLeNET project can be characterized as a step backwards to the first "phase" of m-learning, a focus upon devices. However, the MoLeNET project had a robust focus on developing a model of professional development and support for educators, and a rigorous evaluation process.

The funding available from LSC was ring fenced for spending on capital equipment, and evidence from previous initiatives over many years indicated that it is very difficult to achieve ongoing change with one-off capital funding, as there is a tendency for initiatives to die when external funding runs out. Therefore, it was necessary to develop

sustainability strategies to maximize the likelihood of any introduction of m-learning continuing beyond the initial funded phase (Attewell, 2008, p 28).

M-Learning Research Funding

The level of government funding of m-learning projects in the UK has spawned a very active m-learning research community, and, as a consequence, the UK is regarded as "leading" the world in m-learning research (Sharples, 2009). The availability of m-learning research funding has sometimes led to the exploration of bizarre, overly complicated projects that push the boundaries of the current mobile technology but do not produce widespread adoption or pedagogical transformation. However, some of these projects have produced sustainable models, for example the development of OOKL (an anagram of LOOK) as a framework for interactive museum visits, facilitating links to reflective classroom presentations (Sharples, Vavoula, Meek, Lonsdale, & Rudman, 2007). The focus of much of this government funding has been on "at-risk" learners, accounting for the high percentage of m-learning projects in this context. In comparison, m-learning research projects in countries with smaller population sizes such as Australia and New Zealand are typically funded on a "shoe-string" budget. As a result, these m-learning projects are generally smaller in scale than the large-scale UK projects such as MoLeNET, and have tended to be more focused upon exploring cost-effective m-learning implementation strategies (Bell, Cockburn, Wingkvist, & Green, 2007; Chan, 2007; Clark, Sutton-Brady, Scott, & Taylor, 2007; J. Herrington et al., 2009; Mackay, 2007; Mellow, 2005; Nalder, Kendall, & Menzies, 2007).

M-Learning Project Contexts

A list of a range of up-to-date m-learning projects from around the world can be found on the International Association for Mobile Learning website (2012; www.iamlearn.org/projects). The listed projects encompass a wide variety of m-learning implementations. Many projects involve the development and use of proprietary software (and sometimes hardware) that is often platform specific (for example, Windows Mobile) or Java-based, and also often only has a limited "shelf-life," as the designed-for devices go out of date quickly. The software is also usually task specific and hard to customize. These projects balance investment in high levels of technology support and development against low levels of user training required (simple and task-specific interfaces). These projects require high technical expertise (specialist mobile-application programming knowledge) and are, therefore, often complicated and difficult to transfer to widespread adoption.

European m-learning research has focused upon the context affordances of mobile devices. In their summary of European m-learning research, Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sanchez, and Vavoula (2009) concluded:

> While delivery of educational content to mobile devices may have specific uses in training and professional development, there are other approaches to mobile learning that can make better use of the distinctive properties of mobile technology, including context-based guidance, learning through conversation, and mobile media creation. (p. 19)

For example, Cook's (2010) m-learning research projects focused upon augmenting the learners experience in the field, and, in reflection, he asks, "How do we get beyond good

and useful exemplars?" (Cook, 2009b, p. 35). He proposes that to get wide-scale practitioner and institutional uptake requires an institutional cultural change. Several criticisms can be leveled at these "exemplars": the projects do not demonstrate a focus upon student-generated content or contexts, as they are predefined; there is no long-term change in student learning paradigms, as these are short, day-long projects with no longitudinal scaffolding for students to personally appropriate the use of the mobile tools beyond the project; the students involved are self-motivated learners and in small numbers, minimizing transferability; and there is a high technical requirement for these projects, involving the development of project-specific and intricate augmented-reality multimedia.

Cochrane (2010) and Cochrane and Bateman (2010, 2011) propose an alternative approach to m-learning design to minimize the technical expertise required for m-learning implementation and maximize transferability, while explicitly using a social-constructivist pedagogical foundation, focusing upon the potential of Mobile Web 2.0. Mobile Web 2.0 enables learner-generated content and learner-generated contexts, as suggested by Cook, Bradley, Lance, Smith, and Haynes (2007) and Luckin et al. (2008), guided by the pedagogical integration of these into their courses, as emphasized by Herrington and Herrington (2007) and Laurillard (2007). Examples of m-learning projects with a focus on freely available Mobile Web 2.0 tools and a social-constructivist pedagogy include the work of Chan (2007), the JISC-funded Mobilising Remote Student Engagement (MORSE) project (Andrew, Hall, & Taylor, 2009), and the m-learning projects at the University of Wollongong (A. Herrington, 2008; J. Herrington et al., 2009; J. Herrington, Mantei, Herrington, Olney, & Ferry, 2008). Chan investigated the potential of moblogging to support work-based learning for apprentice bakery chefs. The MORSE project (November 2008 to October 2010) investigated the use of Mobile Web 2.0 tools to support students away from the institution during field trips and work placement (ranging from one day to two weeks' duration, up to 15 times per year). The University of Wollongong projects were a series of short-term (six-weeks long) m-learning projects based around the affordances of institutionally loaned Palm Treo smartphones and iPods in tertiary education.

M-Learning Research Methodologies

Chen, Millard, and Wills (2008) evaluated the 40 research papers submitted to MLearn2007, categorizing the 17 m-learning scenarios described according to a four-category framework (learning objective, learning environment, learning activity, and learning tools), to establish how student-directed these projects were. Only two papers demonstrated alignment with being student-directed in all four categories (see, for example, Cochrane, 2007). The authors, therefore, concluded that, "In essence m-learning researchers are reinventing the VLE on the mobile device, rather than looking at how we could use them to support more subtle aspects of informal learning, and thus the increasingly important PLE area" (Chen et al., 2008, p. 88).

This selection of the m-learning research literature therefore indicates that the majority of current research has focused upon delivery of content to mobile devices (teacher generated and controlled), rather than student-generated content and contexts.

Another review of MLearn2007 and 2008 papers (Wingkvist & Ericsson, 2009) classified and critiqued the research methodologies reported in these papers. All 76 full papers were classified according to eight research methodologies (case study, field study,

action research, experiment studies, survey research, basic research, applied research, and normative research) and four research purposes (describing, developing, understanding, and evaluating). The reviewers found that the representative m-learning research consisted predominantly of small-scale descriptive case studies, with little evaluation and reflection witnessed. An action-research methodology was used by only 5 percent of these papers. This indicates that there is a significant gap in the literature of m-learning research dealing with longitudinal action-research projects. With some notable exceptions (for example, MoLeNET), m-learning research has been predominantly characterized by short-term case studies focused upon the implementation of rapidly changing technologies with early adopters but with little evaluation, reflection, or emphasis on mainstream tertiary-education integration.

Identifying the Gaps in M-Learning Research

The author's review of the m-learning literature indicates that, to date, there are several common shortcomings in the majority of m-learning research:

- a lack of explicit underlying pedagogical theory (Traxler & Kukulska-Hulme, 2005);
- a lack of transferable design frameworks (Armstrong et al., 2008; Sharples, Crook, et al., 2009);
- a general lack of evaluation of the projects (Kukulsa-Hulme & Traxler, 2005; Vavoula & Sharples, 2009);
- a lack of longitudinal studies (Traxler & Kukulska-Hulme, 2005);
- a lack of the importance of pedagogical integration (Laurillard, 2007);
- a lack of explicit student and lecturer support and scaffolding (Attwell, 2007; J. Herrington & Oliver, 2000);
- a lack of awareness of the ontological shifts (Chi & Hausmann, 2003) required for both the learners' conception of learning and the lecturers' conception of teaching. Often, "net generation" skills are assumed (Barbaux, 2006), and most of the case studies consist of lecturers who are early technology adopters (Armstrong et al., 2008).

However, the identified shortcomings can be addressed by the explicit planning and investigation of these issues within m-learning research-project design. Although the first four identified shortcomings of m-learning research have been signaled by several researchers, there has been little emphasis upon the last three shortcomings identified here. The author believes that this is the result of the focus of the three phases (see the following section) of m-learning research upon short-term projects that explore m-learning mainly within informal learning contexts, with little focus upon sustainable integration of m-learning into formal education contexts.

In summary, the literature indicates that there is a gap in m-learning research around the integration of Mobile Web 2.0 within longitudinal projects focused upon learner-generated content and learner-generated contexts.

FOCUSING ON THE FUTURE OF M-LEARNING RESEARCH

There is a wealth of research into the use of mobile devices in education that can be utilized for future research: for example, the JISC-produced guide to implementing

m-learning within a tertiary institution (Joint Information Systems Committee, 2005), user evaluation surveys for implementation trials, and a manager's framework for implementing m-learning in higher education (Knight, 2005). More recently, JISC has produced a mobile review (Belshaw, 2010), and an m-learning info kit (Belshaw, 2011).

The unique potential impact of m-learning on education is founded upon the rise of mobile devices to almost ubiquitous ownership (International Telecommunications Union, 2009) and their primary functionality as ubiquitously connected communication devices. These two characteristics of wireless mobile devices enable their use as disruptive devices to act as catalysts for pedagogical change by mediating student-generated learning contexts and sharing student-generated content as key elements of social-constructivist learning, or Pedagogy 2.0 (McLoughlin & Lee, 2010). The 2010 JISC mobile review (Belshaw, 2010) concludes that m-learning presents the potential to drive innovation in education:

> Mobile learning may mean different things to different people, but it is the dialogue that an institution begins with itself, its staff, its learners, its community—that matters. It is certainly not time for "business as usual". It is time to define and start driving innovation.
>
> (p. 63)

This potential for innovation is both driven and hampered by the rate of change in mobile technologies. Although the rate of change of mobile technology is very high, the author argues that the choice of a pedagogical framework and foundational pedagogical theory can guide the appropriate pedagogical use of future m-learning developments.

CONCLUSION

As the field of m-learning research enters its second decade of intense publication, it is an appropriate point at which to take stock of where we have been and where we should head in the future. This chapter identifies gaps in the m-learning literature and research, predominantly around the immaturity of the research approaches and evaluation strategies taken. In order to realize the unique potential of m-learning as a catalyst for pedagogical change, researchers need to look beyond a continual series of short-term projects. We must become more critically reflective and look towards sustainable approaches, such as focusing upon student-owned devices for enabling student-generated content and student-generated learning contexts.

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