

The New Literacies of Mobile Learning

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ABSTRACT

The New Literacies of Mobile Learning

Sharon Casey

This study, which is based on a comprehensive literature review, brings together several strands of research to examine the literacy implications of mobile learning. It begins with an overview that provides popular definitions and examples, a history of the development of mobile learning, and a brief examination of its major claims and challenges. This is followed by a review of emerging theories of mobile learning, with an emphasis on how it can be distinguished from elearning and on how it relates to other forms of learning. The literacy discussion begins with an introduction to the socio-cultural model of literacy, followed by an analysis of research that demonstrates the social, cultural and epistemological challenges of digitally based learning and, by extension, mobile learning. The review concludes with research on readiness for mobile learning, attempting to balance its potential for enriching and empowering some learners with the risk that it will alienate and disable others.

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After all the research that has been conducted into new technologies and learning the most positive case scenario is that *some* new technologies help *some* people in *some* instances (Jewitt, 2006, p. 1).

The New Literacies of Mobile Learning

Interest in mobile learning, superficially defined as learning that uses portable hand-held devices such as telephones, personal digital assistants and audio players, is increasing. Despite its early status as a continuation of and response to the shortcomings of e-learning, as well as speculation that after an initial period of development it would quickly become a subset of e-learning, mobile learning continues to develop as a distinctive, if ill-defined field (Traxler, 2009a). Currently, development of theoretical conceptions lags behind the pragmatic conceptualizations emerging from a range of relatively short-term and small-scale mobile learning projects (Traxler, 2009b).

Leaders in the field of mobile learning contend that mobile technology has the potential to redefine knowledge, learning and education (Traxler, 2007b). Mobile technology, especially the 3rd generation or smart-phone, has built-in cameras and microphones and easily accessible third-party software that turns it into a source of reference and reading material and tools for calculating, measuring, productivity, and social networking (Johnson, Levine, & Smith, 2009). In fact, mobile telephones provide products, knowledge and cultural processes that increasingly permeate our lives and may be rapidly approaching a state of invisible insertion in everyday life (May & Hearn, 2005). Cell phone penetration

in Canada ranges from 65.5% of households in Quebec to 84.5% of households in Alberta, with the national average at 74.3%, and in households composed solely of 18-34 year olds, 34.4% rely exclusively on mobile phones (Statistics Canada, 2008). It is increasingly reported that mobile technology is changing the way we gather and process information and communicate with others, and that formal education will have to turn to mobile learning to attract, communicate with and retain learners (Alexander, 2004; Wagner, 2005; Johnson, Levine, & Smith, 2009; Pachler, 2009).

Mobile learning can be placed at the centre of some important trends that are likely to continue to develop over the next two decades: ubiquitous computer technology, constant connection to networks that provide access to knowledge, resources and people, and the increasing personalization of learning (Facer, 2009). This review is an exploration of what research reveals about how mobile learning is defined, what contribution it can make to education, how it relates to the emerging understanding of epistemology in the digital age, and what new literacies may arise from its adoption. Drawing on the work of educational leaders in the field of mobile learning, this review will examine the affordances and the challenges of mobile learning, attempting to identify promising opportunities for the future as well as literacy-related problems to be resolved. Since most of the proposed applications for mobile learning seek convergence with Internet applications that increase participation by facilitating syndication and authoring

capabilities (e.g. social networking sites, blogs, wikis,¹ forums, video and photo sharing), these social practices must be examined as well. At the centre of the discussion is whether mobile learning is part of the “calm technology” of ubiquitous computing that is so embedded in our lives and social practices that it can be taken for granted (Galloway, 2004) or whether its increasing invisibility has the potential to define a significant part of the population as disabled, as outlined in Bruce and Hogan’s (1998) ecological model of literacy.

1 “A ... set of linked web pages, created through the incremental development by a group of collaborating users [Leuf and Cunningham, 1999], and the software used to manage the set of web pages” (Wagner, 2004).

Overview of Mobile Learning

Popular Definitions

Mobile learning, often referred to as m-learning, is a new field and it has no established definition. Definitions in popular media generally identify it simply as learning using handheld devices: mobile telephones, laptop computers, personal digital assistants (PDAs), handheld gaming devices, personal digital audio players, digital cameras, digital video cameras and radio frequency identification tags (RFID) (Alexander, 2004). Major current mobile learning projects tend to involve some level of blending with traditional and/or e-learning, using fixed technology such as desk-top computers to follow up on what has been done in mobile contexts (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009). Kukulska-Hulme and Traxler (2005) go further in suggested that mobile learning “will seldom, if ever, be used in isolation to support learning” (p. 42).

Brief History of Mobile Learning

In a review of European innovation in mobile learning, Kukulska-Hulme et al., (2009) provide a useful overview of some of the key developments in the field of mobile learning. Although there is a brief discussion of the Dynabook concept of the 1970s, the authors locate the origins of interest in mobile learning in trials of early handheld devices (Microwriter, Psion computer) in schools in the 1980s. This was followed by research projects in the 1990s on the use of pen tablet and PDA devices for learning, including the HandLeR, which was based on Pask’s

theory of learning as conversation (as cited in Kukulska-Hulme et al., 2009). The HandLeR (Handheld Learning Resource) was a device designed to provide both a digital learning guide or mentor and a means of interaction. The HandLeR project identified major problems with the technology of mobile learning and helped establish the general requirements for supporting contextual life-long learning.

The first major developments in what is commonly recognized as mobile learning were *MOBIlearn* and *m-Learning*, research projects funded by the European Commission in 2001-2002. *MOBIlearn* ran from January 2002 to March 2005 in ten countries, with the goal of “exploring context-sensitive approaches to informal, problem-based and workplace learning by using key advances in mobile technologies” (MOBIlearn, 2002). The m-Learning project ran from 2001 to 2003 and focussed on the use of mobile learning with disaffected young learners who had failed in the traditional education system (M-learning, 2005). Kukulska-Hulme et al. (2009) identify the key contributions of these projects. *MOBIlearn* redirected attention from the mobility of devices to the mobility of learning and launched the development of theories for mobile learning. The m-Learning project established the importance of using mobile learning in blended learning activities and its potential for learning through creativity, collaboration and communication. In another development in 2002, the first of the international *mLearn* and *IEEE International Workshop on Wireless and Mobile Technologies in Education* conferences were held. These led to a

series of such conferences, mostly in Asia and Europe, which provide the bulk of research to date on mobile learning.

Examples of Mobile Learning Applications

Mobile content delivery. Content designed for easy access by mobile phones and PDAs can be delivered to learners enrolled in formal education or to the general public. For example, Athabaska University has launched a multimedia English Second Language program with grammar lessons and interactive exercises designed for mobile devices and available free to anyone with Internet access. Another form of content delivery is podcasting, the creation and broadcasting of audio and video files over the Internet for playback on portable devices and personal computers (Lee & Chan, 2007). Podcasts can now be created by simply speaking into a mobile phone (Kolb, 2008). In an interesting blend of formal and informal learning, podcasts of lectures, conferences and other audio material are provided free to the general public by a range of colleges and universities through Apple Computer's iStore.

Mobile academic support. Mobile devices can be used to communicate with students for administrative and academic support. For example, SMS (short messaging system, i.e. texting) can be used to provide scheduling information, reminders, tutoring, instructional messages, feedback on assignments, assessments, and motivational messages (Brown, 2005). In a local example, Physics teachers at John Abbott College are experimenting with the delivery of homework assignments by SMS that would encourage students to connect the physics taught in courses to real-world applications. In the proposed project,

students would receive a question via SMS that requires them to identify and describe in context one or more phenomena that were covered in class (M. Dugdale, personal communication, April 30, 2009).

Mobile field work. Mobile phones and other connected hand-held devices can be used to gather data from the environment and to track and organize user-generated data via websites (Scanlon, Jones & Waycott, 2005). Using speech-to-text software, verbal notes can be sent as email texts (Kolb, 2008). One example of mobile field work from a formal learning context is research done by Swedish university students on the Sámi winter market; the students used mobile phones to record interviews and digital video footage and to take digital photos, and then posted audio files, video clips, photos, and text on a web site available to the public (Alexander, 2004; Lankshear & Knobel, 2006a). Fieldwork can also be part of informal learning. For example, in the UK, bird watchers can use mobile devices to access a bird-identification database designed for mobile phones by the Royal Society for the Protection of Birds.

Mobile collaboration. Mobile technology facilitates collaborative learning in context, as demonstrated by the MoTFAL project (Geddes, 2004). In this project, students in Spain explored archaeological sites while connected via Internet with students in Greece. Using digital-camera enabled PDAs, the Spanish students collected data requested in real time by their Greek counterparts. The process was then reversed. Mobile phones can also be used for telephone conferences with recording capability, enabling innovative applications such as virtual guest speakers (Kolb, 2008).

Mobile digital video creation. Mobile devices can be used to create, view and share digital video. For example, staff members at a hospital in Sweden created digital videos demonstrating the use of equipment, which could be called up and viewed in the presence of the equipment on hand-held video players (Brandt & Hillgren, 2003). Mobile phones equipped with digital video cameras can be used to create and share videos between mobile phones or via Internet video sharing sites such as YouTube (Becta, 2003; Burden & Kuechel, 2004; Kearney & Schuck, 2005). Online editing software is also available (Kolb, 2008).

Interactive museum exhibits. Interactive museum exhibits combine technology for location awareness with the delivery of online content to provide on-demand multimedia tours for users. For example, visitors to the Tate Modern Gallery in London can rent a small PDA that provides instant access to text, video, still images and interactive games providing additional information on the art on display, interviews with artists, and videos of the artists at work.

Affordances of Mobile Learning

A detailed analysis of the affordances and challenges of mobile learning is beyond the scope of this review; however, before focussing on literacy issues, it is important to highlight some of the major claims for and problems in mobile learning to provide context for this discussion. Underpinning discussions of the affordances of mobile learning is the assumption that it will be used in tasks and contexts where it is most appropriate and where it has significant advantages over other forms of learning. While many mobile learning applications merely apply new tools to existing learning scenarios, there are innovative and

appropriate uses mobile technology that stem from collaborative, contextualized, and constructivist philosophies of learning (Patten, Arnedillo-Sánchez, & Tangney, 2006). Many of these applications are, in fact, blended learning models where mobile technology provides a bridge to other formal and/or informal learning activities (Vavoula, Sharples, Rudman, Lonsdale, & Meek; 2007).

Individual, collaborative and situated learning. Perhaps the greatest affordance claimed by proponents of mobile learning is the potential for employing what Ryu and Parsons (2009) call the three pillars of learning: individual, collaborative and situated learning. Individual learning with connected mobile devices suggests the possibility of enhanced constructivist learning (Alexander, 2004; Geddes, 2004; Naismith, Lonsdale, Vavoula, & Sharples, 2004; Naismith & Corlett, 2006; Ryu & Parsons, 2009). It may facilitate learning on demand (Alexander, 2004), multitasking and increased productivity, (Alexander, 2004; Geddes, 2004) and create the potential for all environments to become sites of learning (Alexander, 2004; Ryu & Parson, 2009). Its claims include increased access, not just across location and time, but also across groups, because the technology is less expensive (Geddes, 2004). Mobile learning also offers the promise of inquiry-led and situated learning, in authentic tasks undertaken in the real world in which the technology may be used to bridge formal and informal learning (Geddes, 2004; Naismith et al., 2004; Vavoula et al., 2007; Ryu & Parsons, 2009), as well as support for informal, lifelong learning (Naismith et al., 2004). Mann and Reimann (2007) suggest that mobile learning

may actually offer a convergence between formal and informal learning, providing opportunities for curriculum-oriented informal learning, although it could be argued that learning that is connected to curriculum ceases to be informal.

Affect and motivation. Another of the benefits of mobile learning may be increased motivation and engagement in learning. Ownership of mobile devices may increase motivation by providing opportunities for appropriation, control and the ability to modify both the technology and the learning activity for the learner's own purposes (Issroff, Scanlon, & Jones, 2007). Mobile learning can provide synchronous real-time interaction that enhances a sense of presence and the affective dimension of learning by juxtaposing mobile social space and physical space (Danaher, Hickey, Brown, & Conway as cited in Danaher, Gururajan, & Hafeez-Baig, 2009; Traxler, 2009a). However, it must be noted that some researchers question the degree of synchronicity in mobile learning (Anderson, 2004; Hiltz, Coppola, Potter, & Turoff in Danaher et al., 2009) Finally, engagement may also be promoted by the flexibility in learning, teaching and assessment it offers and by the opportunities it provides for innovation in applications and pedagogy (Danaher et. al., 2009).

Challenges of Mobile Learning

Technical limitations to usability. Currently, there are technical limitations to the potential of mobile learning such as relatively small screen size and low screen resolution, limited battery life, low memory, difficulties accessing the Internet, limited and slow bandwidth, lack of standardization and compatibility across hardware platforms and software, and difficult or inconvenient input systems (Kukulska-Hulme, 2005; Wang & Higgins, 2006). However, the technology changes quickly and research and design is already addressing these issues. For example, pico projectors allow mobile phone and PDA screens to be projected on any flat surface and the first mobile phone with a built-in projector was introduced in the US in January, 2009 (Cadden, 2009). Battery life problems may even someday be resolved by nanogenerators that could harvest energy from body movement (CBC News, 2009). In a realm that seems to be overtaking science fiction, there are labs now working on mobile computers that would be controlled by neural impulses (Vavoula et al., 2007). At the risk of straying into technological determinism, it seems unproductive to focus too closely on technological limitations of this nature. In discussing challenges associated with devices, it may be more beneficial to focus on issues that have arisen in major mobile learning projects and that would have to be addressed in any technological context.

Other limitations to usability. Users of mobile technology for learning encounter barriers that, I would argue, are not as easily addressed by advances in technology. Perhaps most importantly, the mobility of the devices is, ironically,

a serious barrier itself, in that mobile learning is likely to be fragmented, to be frequently interrupted and to take place in physical contexts that are not conducive to learning (Kukulska-Hulme, 2007). Another barrier is the product life cycle of mobile devices, particularly mobile phones, which is so short that users may be continually moving on to new devices before they have learned to fully exploit the old ones. Kukulska-Hulme (2007) points out that there is little research on how people learn to use mobile devices over time and the role that individual ownership and social networks play in this learning. Furthermore, difficulties arising from the variety of devices and types of connectivity available and the lack of dedicated educational software and applications are issues of markets and business models rather than technology (Kukulska-Hulme, 2005). Currently, mobile technology is still designed, marketed and delivered for business and recreation; educational uses are “parasitic and secondary” and are constrained by the original design of the device (Traxler, 2007a). Another of the challenges to mobile learning is the cost, incurred by learners in using connected devices (Stockwell, 2008), and incurred by educational institutions for acquiring and maintaining infrastructure, technology and services (Vavoula et al., 2004). Other barriers include issues around training and support for learners, teachers and content creators; suitability of devices for intended uses; and security and privacy for end users (Vavoula, Lefrere, O’Malley, Sharples, & Taylor, 2004).

Pedagogical challenges. In addition to usability concerns, there are particular pedagogical challenges in mobile learning. Like any ICT-mediated educational endeavour, mobile learning works in certain contexts and not others;

mobile devices may be best at content-light tasks that involve individual reflection and communication with others (Kukulska-Hulme, 2005). Mobile devices have the potential to provide vast amounts of information in relatively small chunks, creating an increased “navigational overhead” and having an impact on how (or whether) knowledge is connected, accessed and valued (Traxler, 2009a, p. 9).

There is also concern about how mobile learning will be evaluated. Vavoula and Sharples (2009) have identified six challenges to evaluation in mobile learning: capturing / analyzing learning in context, measuring processes and outcomes, respecting privacy, assessing usability and utility of technology, considering the organizational and socio-cultural context, and assessing ‘in/formality’. Vavoula and Sharples point out that capturing and analyzing mobile learning is challenging, insofar as mobile learning is conceived as crossing between formal and informal contexts, in that there is little or no consistency or predictability in physical setting, social setting, objectives and outcomes, methods and activities, progress and history, and the learning tools used. Technology designed to address this concern (e.g. devices for eye tracking, interaction capture kits) has limitations, most notably obtrusiveness for the user. The use of learner accounts (e.g. interviews, attitude surveys, diaries) is constrained by issues of accuracy of recall and the interference of post-rationalization and the learners’ concern over how they may be perceived (Vavoula & Sharples, 2009). Some promising approaches suggested by Vavoula et al. (2004) are applying the Critical Incidents method (Flanagan as cited in Vavoula et al., 2004) to identify observable incidents that demonstrate the extent

of learning in context, and evaluating learner-produced artefacts (e.g. media, blogs, e-portfolios, log files for computer activity or web access, results of online quizzes).

Socio-cultural challenges. Beyond usability issues, mobile devices in themselves bring unique challenges to participating in the socio-cultural practices of mobile learning. For example, successful use of mobile technology for learning involves fragmented, context-dependant use and demands that we learn new ways of communicating, e.g. the acronyms of SMS (Kukulska-Hulme, 2005). Another of the challenges to mobile learning, especially in activities that call for the use of devices in real-world contexts, is the uncertainty surrounding the social rules about the acceptable use of handheld technology (Kukulska-Hulme, 2005; Kukulska-Hulme et al., 2009). Roschelle (2003) points out the need for a better understanding of the effects of the use of mobile devices in the same social space as more traditional or formal teaching and learning, where learners are participating simultaneously in the physical social environment and the online social environment of connected devices. Furthermore, questions may be raised about whether mobile learning, increasingly viewed as a continuous lifelong activity, allows us freedom from constant engagement (Menzies, 2000; Wang & Higgins, 2006; Kukulska-Hulme et al., 2009). These issues will be discussed in further detail in Chapter three.

Theories of Mobile Learning

Challenges in Establishing Definition and Theory of Mobile Learning

Commonly cited applications of mobile learning suggest several emergent categories: technology-driven; miniature but portable e-learning; connected classroom learning; mobile training and performance support, large-scale implementation; inclusion, assistivity and diversity; informal, personalized, situated; and remote, rural and development mobile learning (Traxler, 2009a). Tensions between definitions in the mobile learning community of practice, which communicates more via international conference than dedicated journals, are centred on where the emphasis on mobility is placed- technology and devices, the location of learning, or the experience of the learner (Traxler, 2007a; Traxler, 2009a). The following definitions illustrate some of this debate.

Technological definitions. Early definitions of mobile learning are focused on technology, e.g. “Any educational provision where the sole or dominant technologies are handheld or palmtop devices” (Traxler, 2009a) and “the provision of education and training on PDAs/palmtops/ handhelds, smartphones and mobile phones” (Keegan as cited in Traxler, 2009a). It has been argued that this identification with technology creates unstable definitions and theories tied to transient and diverse devices and platforms, does not distinguish mobile from other types of learning (e.g. the book is a highly mobile device), and allows mobile learning to be subsumed in the continuum of e-learning (Taylor, Sharples, O’Malley, Vavoula, & Waycott, 2006; Traxler, 2009a). In response, Traxler (2009b) calls for definitions and theories of mobile learning

that can demonstrate its potential to enrich the concept of learning and extend learning to socially or geographically remote individuals, communities and countries.

Anytime, anywhere learning. Some early definitions add an emphasis on mobility of the learner, as in “Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies” (O’Malley et al. as cited in Traxler, 2009a). Others emphasize both ubiquity and connection: “M-learning refers to the delivery of learning to students anytime and anywhere through the use of wireless Internet and mobile devices, including mobile phones, personal digital assistants (PDAs), smart phones and digital audio players (Y-S Wang, Wu, & H-Y Wang, 2009, p.93). Early definitions also associate mobile learning with informal and lifelong learning, e.g. “The acquisition of any knowledge and skills through using mobile technology anywhere, anytime, that results in an alteration of behaviour” (Geddes, 2004, p. 1).

C³ learning. Sims (2008) proposes replacing the term mobile learning with C³ learning for “technology-enhanced environments that enable collaborative, contextual, and connected learning” (p. 154) in which the roles of designer, teacher and learner become interchangeable. In collaborative learning, Sims identifies the unique contribution of mobility as the potential to blend formal and informal learning and learners. He contends that C³ learning offers the potential to overcome constraints of context, by shifting responsibility to the

learner for personal, contextual and cultural needs within the collaborative environment. Finally, drawing on the work of Wenger, Sims suggests that the unique affordance of C³ learning for connection is the enhanced potential for the formation of communities of practice within the emerging environments of second life, social networking and person-to-person data sharing (e.g. YouTube).

Criteria for Definitions and Theories

One of the challenges of defining and developing theories for mobile learning, then, is moving beyond hardware to understand how it can be distinguished from other forms of learning and particularly from e-learning. Traxler (2009a; 2009b) has argued that the differences between mobile learning and tethered e-learning are in the learner experience of mobility, and in personal ownership, informality and context. Criteria have been suggested for assessing definitions and theories of mobile learning according to their ability to distinguish mobile learning from other theories of learning, to account for the mobility of learners and the dynamic context (physical, information and social settings) of learning and the extent to which it can be applied to both formal and informal learning (Sharples et al., 2005; Taylor et al., 2006). One way to resolve some of the difficulty in establishing a definition that addresses these criteria may be to place the emphasis on the mobility of the learning rather than the devices and/or learners. For example, Traxler (2007a) has called for a definition that takes into account personal, contextual and situated learning and that addresses the tensions between formal and informal learning. Current research on mobile learning is based on theoretical definitions that emphasize the mobility of context

as a central concept (Sharples, Taylor, & Vavoula, 2006; Traxler, 2007a; Wali, Winters, & Oliver, 2008; Traxler, 2009a; Kukulska-Hulme et al., 2009).

Mobility of context. Context in mobile learning is created and re-created continually through the interactions of people with their environment and the technology of every day life (Kukulska-Hulme et al., 2009). Using the central construct of context, Sharples et al. (2006) define mobile learning as “the process of coming to know through conversations across multiple contexts amongst people and personal interactive technologies” (p. 4). This constructivist process can be applied to the individual and to organizations, communities and cultures and can be applied to both humans and technology-based teaching and learning systems (Sharples et al. 2006; Taylor et al., 2006). Similarly, Wali et al. (2008) interpret mobile learning through activity theory, moving the focus from technology to context-crossing, where the mobility of learning is the continuity of activities across contexts and where emphasis is placed on the relationship between learning and social context. Building on the work of Kakiyama and Sorensen, Kukulska-Hulme et al. (2009) interpret the term ‘context’ as an overarching construct which covers mobility in physical space (where location may or may not be relevant to learning), of technology (including transfer of attention across devices), in conceptual space (moving from topic to topic based on interest or commitment), in social space (participating in different social communities) and over time (across formal and informal learning experiences).

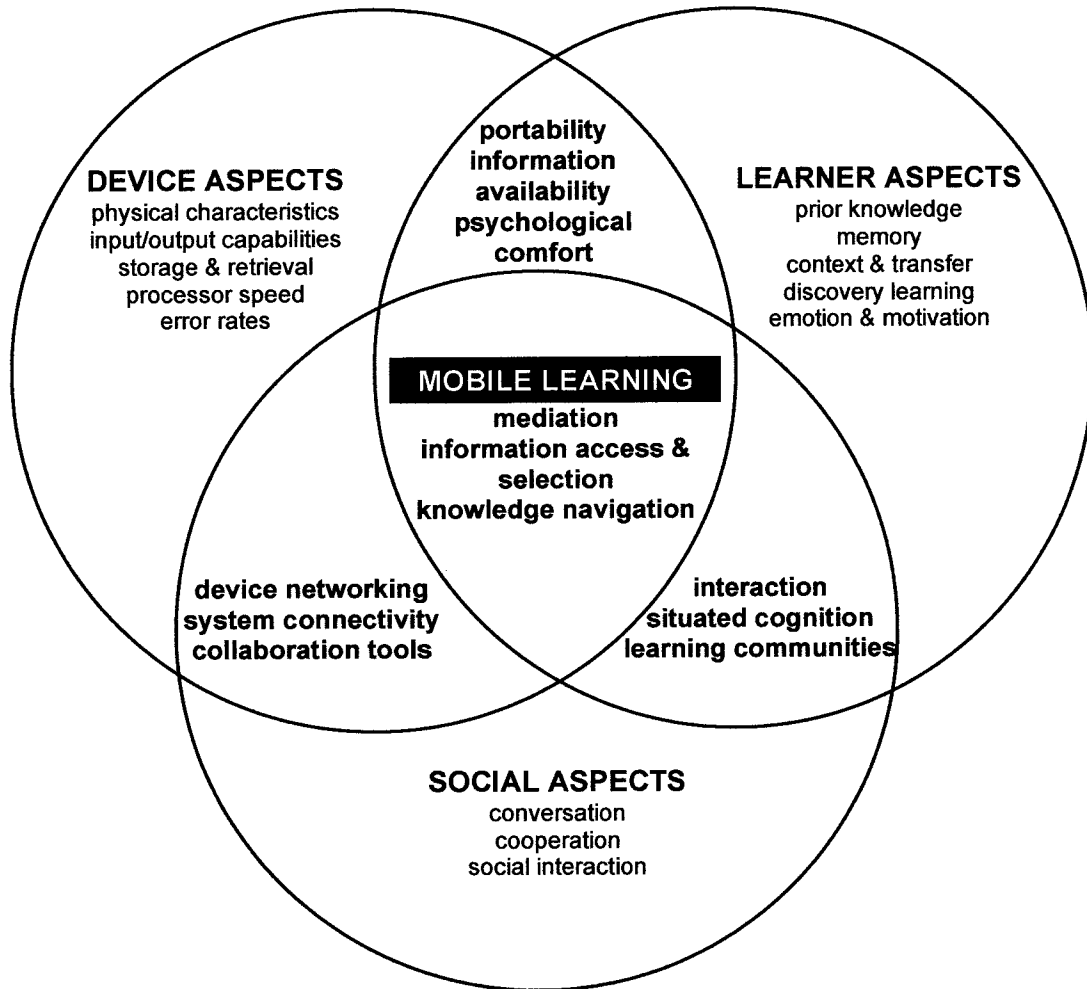
FRAME model for mobile learning. Koole (2009) has developed a model that brings together many of these ideas, mapping out mobile learning as

the intersection of device, learner and social aspects of learning. She draws on constructivism, Activity Theory and the Vygotskian concepts of mediation and proximal development to create the FRAME model for mobile learning. The FRAME model (Framework for Rational Analysis of Mobile Education) identifies mobile learning as the intersection of the device, learner and social aspects of learning: “The FRAME model describes a mode of learning in which the learner may move within different physical and virtual locations and thereby participate and interact with other people, information or systems—anywhere, anytime” (p. 26). This is similar to the conceptualization of learning as conversation, which does not distinguish between people and technology but places them on equal footing in the learning process (Sharples et al., 2006). The FRAME model is particularly useful in that it describes the ideal mobile learning situation and provides a framework to evaluating mobile learning projects and design.

The following diagram demonstrates the major components of the FRAME model. The role of the device aspect (physical, technical, and functional characteristics) is to provide the interface between learner and task. The learner aspect describes how individuals use cognitive ability, memory, prior knowledge, affect and motivation and how they encode, store and transfer information (p. 29-30). The social aspect describes the communication and cooperation “enabling them to exchange information, acquire knowledge, and sustain cultural practices in both physical and virtual contexts (p.31). The affordances of mobile learning are demonstrated at the convergence points of each sector, with the ideal mobile

learning situation as the convergence of all three factors: device, learner and social.

FRAME Model for Mobile Learning (adapted from Koole, 2009)



Mobile habitus of learning. Kress and Pachler (2007) offer a unique definition of mobile learning that locates mobility in a new *habitus* of learning. This mobile habitus is characterized by a more fluid and provisional relationship between authors and readers, requiring the learner to have immediate and ubiquitous access to resources. There is a significant departure from the text-

making of what might be called immobile learning, in which the author-reader relationship is stable, with an authoritative author who assembles knowledge and dictates the order of the text, establishing power and canonicity. Kress and Pachler place mobile learning in a digital epistemology, where text-making is characterized by collaboration and provisionality. In this mobile relationship between authors and readers, the readers establish the order of texts according to their own interests. Subjects are thus modelled as creative participants rather than passive consumers. This fits the new semiotic theories outlined by Kress (2000a; 2000b), moving us from reading with text as authoritative source of knowledge to design, with the text as a resource of the production of knowledge through transformation and re-creation. To move from reading to full participation in design, learners must have a full understanding of the communicational, including ideological and political, potentials of the resources available to them (Kress, 2000a, p. 160). Successful mobile learning involves the ability to bring disparate things together, to function in a state of contingency and incompleteness and to be able and ready to turn any environment into a learning site (Kress, 2000a, p. 208).

Theoretical Focus of this Review

This study defines learning as the acquisition of knowledge and understanding through interaction with people, media, and texts (multimodal or other), in both purposeful participation in formal education and in everyday life. Since mobile learning has only recently launched its first dedicated professional journals, and since the technology that would underpin definitions and theories of

mobile learning is “volatile, inconsistent and haphazard” (Traxler, 2009a), this review does not presume to establish an acceptable definition of mobile learning. However, underlying all the most recent definitions presented here is the idea that mobile learning is far more than the application of new hand-held tools to e-learning. If mobile learning is, as this review suggests, a promising new form of learning with literacy implications that must be considered, it makes sense to focus on definitions that highlight what is unique and challenging about mobile learning. In the context of this discussion, Kress’ mobile habitus of learning is a particularly useful concept for examining the literacy implications of the mobile learning, since it highlights what is fundamentally different about digitally-mediated learning and allows us to focus on the impact of mobile devices on this learning.

Literacy Implications of Mobile Learning

Discussing the literacy implications of mobile learning requires a detailed examination of the definition of literacy itself, both in conventional print formats and in digital texts. Essentially, two areas for exploration emerge. The first is how the New Literacy Studies (NLS) have changed the conception of literacy from its narrow definition as part of the “3 Rs” to a view of literacy as socio-cultural phenomenon. As we have seen above, mobile learning as proposed is collaborative, situational and contextual and seeks to fully capitalize on so-called web 2.0² technologies which are inherently social. Any discussion of literacy implications must therefore take into account the socio-cultural view of literacy. Having established literacy as a socio-cultural phenomenon, the second area for exploration is how this is played out in the digital age, with a focus on new theories of meaning, on what Lankshear, Peters and Knobel (2000) have called the digital epistemology, and on how the new screen-based media shape and change the way we use writing (see Kress, 2003). This discussion points to a

² O'Reilly (2005) coined the term Web 2.0 and defined it as follows:

Web 2.0 is the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an "architecture of participation," and going beyond the page metaphor of Web 1.0 to deliver rich user experiences. (p. 17)

debate on how literacy will be defined in the age of new media, one that raises questions about the relationship between traditional print-based literacy and literacy in digital contexts.

Socio-cultural Definition of Literacy

New Literacy Studies. Current definitions of literacy are complex, extending far beyond the notion of the ability to read and write. The New Literacy Studies (NLS) has shifted the focus of literacy as the acquisition of skills to literacy as a social practice (Street, 2003) and this has had an impact on how it is approached. For example, we see the influence of these ideas in UNESCO's 2005 working definition of literacy as:

the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve his or her goals [sic], develop his or her knowledge and potential and participate fully in community and wider society. (Richmond, Robinson, & Sachs-Israel, 2008, p. 18)

The literacies that arise when people address reading and writing can only be understood in the context of their own understanding of knowledge, and this understanding is socially constructed. Rather than focussing on literacy as a single phenomenon, NLS sees it as a social practice in which there are actually multiple literacies that vary according to time and place and that have contested power relations, since they are based on particular world-views (Street, 2003).

Discourses. In keeping with an NLS view of literacy, Gee (2001) contends that reading and writing can only be understood in connection to speaking, listening, interacting and using language to think about and act on the world. He defines literacy as a socio-culturally situated practice that involves the mastery of Discourses that are essentially identity kits: “ways of combining and coordinating words, deeds, thoughts, values, bodies, objects, tools and technologies, and other people (at appropriate times and places) so as to enact and recognize specific socially situated identities and activities (Gee, 2001, p. 721). Mastering a Discourse is a process of “being-doing” (p. 719) according to the social language of that discourse. It takes into account the genres or combinations of ways with words that express specific socially situated identities and activities, as well as the taken-for-granted knowledge of what is typical or normal within a Discourse.

According to this view of literacy, understanding the implications of mobile learning means understanding the Discourses that are involved in meaningful participation. The Discourses of mobile learning will include those of digital connectivity, a social space with its own values and culture influenced by and layered over existing Discourses. I would argue that these are complex and difficult for most learners, with barriers thrown up by culture, language, geography, gender, age, and so on. Few of us will adapt effortlessly to the Discourses of mobile learning. Ironically, since writing still plays a key role in the digital world and is still the preferred tool of the cultural and political elite (Kress, 2003; Merchant, 2007), young people that have grown up within digital culture

may actually be disadvantaged by their lack of mastery of more traditional forms of writing. Sorting out the literacy implications of mobile learning requires that we examine the socio-cultural implications, the new epistemology and the new theories of meaning that arise in digitally-based learning.

Socio-cultural Implications of Mobile Learning

New context. Some of the most serious literacy challenges presented by mobile learning arise from the current context for learning, which Kress (2008) argues is characterized by globalization, instability and multiplicity and represents a revolution in the meaning, effects and uses of time and space:

... for information of all kinds, the ruling sense of time now is that of the speed of light; the relevant unit of space that of the globe. The effect of these two together, in political, social, economic and cultural terms, in terms of the impact of technologies, whether of transport of information or of people, has been to unmake all former framings and with that of all former certainties, in all domains. (p. 258)

Mobile learning is predicated on digital connectivity and the ubiquity of computer technology, the benefits of which are seldom questioned. This is problematic, considering that mobile technology has the potential to erode the established notions of space and time that have underpinned our understanding of the world (Johnson & Kress, 2003; Traxler, 2009b), and to break down the barrier between public and private space (Traxler, 2009b). Furthermore, the pervasiveness of mobile technology renders space and time invisible and, at the same time, makes invisible the relations of power and control (Galloway, 2004).

The potential effect is demonstrated by Menzies (2000) in an examination of the impact of digital networks on social justice. She argues that since digital media is not grounded in place and time, digital connectivity privileges symbolic over material reality and applies a cultural bias to both how we think and what we think about, placing emphasis on “whatever will compute, whatever can be done online, rather than face to face” and discounting whatever cannot be counted. She points out that the network, the pace, and the rules of engagement are predefined, and this by corporate rather than public interests. She contends that by compelling us to function at a rapid pace with a constant stream of information and disembodied communication, digital connectivity alienates us from embodied space and local social relations, rather than enriching our connection with others. The importance of ubiquity and connectivity to mobile learning poses serious literacy challenges and may contribute to the polarization of those who can master the literacies of digital connection and those who cannot (or chose not to). As Menzies points out, “while digital connectivity is a great leap forward for some, it can be a great leap backward for others, producing a dis-connection, dis-communication and dis-affection rather than real engagement in one’s society” (p. 272).

New “social stuff”. From the perspective of multiliteracies, we must abandon the idea of passive users of stable semiotic systems in favour of “socially located, culturally and historically formed individuals as the remakers, the transformers, and the re-shapers of the representational resources available to them” (Kress, 2000a, p. 155). Looking at the literacies of mobile learning from

a socio-cognitive perspective means exploring what new “social stuff” learners will have to master to participate fully in this transformation and (re)creation. Social languages contain an inextricable mix of oral and written language that is integrated in social practices and connected to “embodied action and interaction in the world” (Street, 2003). They are connected to the values, perspectives and identities of particular groups or communities. Gee (2001) points out that achieving competence in a social language means being able to know how its features can be used to carry out the social activities within a discourse and how to recognize and/or enact the social identity connected with it. All this is further complicated by the fact that people participate in multiple and overlapping discourses (Street, 2003).

It is clear, then, that the literacies of mobile learning cannot be fully understood without examining the cultural and social identities of its participants and without examining the new Discourses they will have to master to participate in a meaningful way. While there is a considerable body of work on digital epistemology and digitally-mediated learning, research is only now emerging on the new social practices that may be part of meaningful participation in mobile learning (e.g. SMS, moblogging³, wikis, social networking, MMORPG⁴). In an economy of attention, it may be that truly meaningful engagement in networked space requires meta-knowledge that is not easily identified and taught, meta-knowledge required to identify and participate in the right affinity spaces, such as

³ mobile blogging

⁴ massively multiplayer online role-playing games

knowing what is “cool” and identifying emerging cultural moves so that one can be there “first and early” (Lankshear & Knobel, 2006a, p. 240).

In the field of mobile learning, much is made of the learning potential of smart mobs, groups of people who use mobile technology to coordinate meetings, share information and resources, communicate, and collaborate, e.g. in environmental and political groups and citizen news reporting (Lankshear & Knobel, 2006a). However, as Lankshear and Knobel point out, the potential for and the quality of this kind of learning experience is highly dependent on the individual’s access to the social networks that form smart mobs. If these kinds of social languages and cultural moves are learned through socialization and immersion in meaningful practice (Gee, 2001), we must consider who will have access to this socialization and immersion and who will be excluded.

The complexity of social practices in mobile learning is also demonstrated by online social networking sites such as Facebook and Twitter, rapidly evolving environments that have only recently been studied. Boyd and Ellison (2008) define social networking sites as

web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others in the system. (p. 211).

The authors note that online and offline experiences are deeply connected, and the construction of identities online is connected to and influenced by ethnicity, religion, gender and sexuality. Construction and management of these profiles is

a complex social task that involves the processes of impression management, self-presentation, and friendship performance. Furthermore, users must be able to make sense of privacy issues that can have a serious impact on their offline lives. The complexity of privacy and the difficulty of controlling online identity are demonstrated by the controversial resignation of Canadian politician Ray Lam following the publication of compromising Facebook photos of him. Lam resigned from the 2009 BC election campaign after a political rival leaked two photos to the media, one of him touching a young woman's breast and one of him wearing only his underwear (The Canadian Press, 2009). Lam had no control over the posting of the photos, which had been taken when he was a teenager and which originally appeared on the private profile of a friend (Lam, 2009). It would appear that the even the best educated young people are not immune to these problems. In a study of unprofessional content posted online, more than half of US medical schools surveyed reported problems with content posted by students; the problems included frankly discriminatory language, reported by 48% of the schools, and violations of patient confidentiality, reported by 13% of the schools (Chretien, K.C., Greyson, S. R., Chretien, J.P., & Kind, T., 2009).

Beyond issues of privacy, social networking environments may require users to manage the potential blurring of their private and professional identities. One concrete example is the debate around the use of social networking by employees. The Associated Press (n.d.) social network policy addresses the issue directly, imposing limits on all employees (not merely journalists) in both

professional and personal communication, as well as making them responsible for what others post to their profiles on social networking sites:

Posting material about the AP's internal operations is prohibited on employees' personal pages, and employees should also avoid including political affiliations in their profiles and steer clear of making any postings that express political views or take stands on contentious issues.

Employees should be mindful that any personal information they disclose about themselves or colleagues may be linked to the AP's name. ... It's a good idea to monitor your profile page to make sure material posted by others doesn't violate AP standards; any such material should be deleted.... We all represent the AP, and we all must protect its reputation.

(n.p.)

Social networking clearly raises a number of ethical and legal issues that have yet to be explored and resolved. For example, courts have yet to establish whether posting content on social networking sites constitutes publishing or the digital equivalent of a private discussion that occurs in a public place. In the US, this has led to a defamation lawsuit launched against a woman who posted a negative comment about her landlord to her 20 followers on Twitter (BBC News, 2009). While the legal, ethical and privacy issues are unresolved, the burden of negotiating these social networking practices rests on the individual and, as the privacy examples alone demonstrate, the price for mistakes can be high.

Given the complexity of social practices proposed, mobile learning may introduce a host of new social languages, genres and cultural models that many

of us will struggle to participate in, let alone master. This difficulty is compounded by the potential for important shifts in how we define knowledge and conceptualize learning. The following section provides an outline of the epistemological implications of mobile learning and the literacy demands that arise in connected, digital contexts.

Epistemological Implications of Mobile Learning

Digital epistemology. In addition to altering the context and social aspects of learning, digitally-mediated learning may represent a radical change in conceptions of knowledge and a new form of learning rather than merely new tools to use within our conventional epistemology (Lankshear et al., 2000; Traxler, 2009a; 2009b). Although a detailed discussion of digital epistemology is beyond the scope of this review, a few key points will be discussed to illustrate the magnitude of the challenge posed by digitally-mediated learning, which introduces ways to use technology with different values, priorities and sensibilities than our book-based culture (Lankshear & Knobel, 2006b). Simply put, the priority of learning in the digital age has shifted from knowing *that* to knowing *how* (Lankshear, 2003).

The construction of knowledge in standard epistemology, produced and expressed in oral and written language for the last two thousand years, is carried out linguistically in sentences/propositions and theories, with images limited to the role of illustration (Lankshear et al., 2000). However, knowledge in digital epistemology can be carried by image and sound that “can behave in epistemologically very different ways from talk and text—for example, evoking,

attacking us sensually, shifting and evolving constantly, and so on” (Lankshear et al., 2000, p. 35). This highlights the relational, collaborative, and distributed knowledge practices that qualify and define content (Lankshear et al., 2000), as well as the need for learners to create their own conceptualizations of learning in context and, perhaps, their own ontologies (Traxler, 2009b). It also requires us to function in a world where knowledge can be seen as a commodity and evaluated according to its efficiency and performativity rather than its truth value (Lankshear et al., 2000; Bereiter & Scardamalia, 2005). In a paraphrase of Lyotard, Lankshear (2003) sums up the importance of performance over truth value and the way that the advantage of having information has been replaced by the ability to arrange information in a new way: “Access to perfect information being equal, imagination carries the day....” (p. 174). In such a context, mobile learning calls on us to provide navigational aids for judgement and evaluation that allow learners to assess their own interests and audience, as well as the resources available to them to produce and disseminate their own representations (Kress & Pachler, 2007).

New theories of meaning. Digital epistemology is a landscape of multimodal semiotic objects that give rise to new and challenging literacies and call on us to develop new theories of meaning (Kress, 2000a; 2000b). Kress (2003) demonstrates how literacy, which he defines as representing meaning using letters, is now only part of a collection of modes we use to communicate meaning, a collection that includes images, moving images and sound. Furthermore, he argues that while writing maintains an important role in the new

media and as the preferred form of the cultural and political elite, it is increasingly dominated by the logic of the image, leading to a “revolution in the uses and effects of literacy and of associated means for representing and communicating at every level and in every domain” (Kress, 2003, p. 1). One aspect of this change can be seen in his comparison of page-based and screen based forms. He contends that in page-based media, the logic or organization of writing is linear, based on sequence and time. Grammatical forms of writing move us from sentence to paragraph to chapter, placing the power to determine the reading path in the hands of the author. In contrast, the logic or organization of the image is that of display; it is simultaneous and its “reading path” (central vs. marginal, emphasis through colour, size, shape, etc.) is more easily re-arranged by the reader.

To illustrate how writing is changing in the new media, Kress (2003) explains how textbooks are increasingly dominated by the logic of the screen and image:

New textbooks are not ‘books’ in the older sense: carefully structured, coherent expositions of knowledge, knowledge to engage with reflectively and to ‘absorb’. The new ‘books’ are often collections of work-sheets; no careful development of complex coherent structures here, and no deliberate carefully reflective engagement with these pages. These are books to work with, to do things with, to act with and often to act on (p. 21).

According to this view, the new media emphasize the visual aspect of writing, creating opportunities to mediate written text and to explore different layers of meaning and alternate meanings, and this challenges the “predominance of the word” (Jewitt, 2006, p. 107). Johnson and Kress (2003) argue that if the screen is increasingly dominant over the page and the book, curriculum must be redesigned in a multimedia and multimodal communicational frame and assessment must be designed to take into account all modes of representation available to learners.

New author roles. Analyzing the literacy demands of multimodal texts calls on us to examine the relationship of writing to other modes that reshape knowledge and author roles (Bezemer & Kress, 2008; Jewitt, n.d). Learning through blogs is an illustration of many of the challenges in this shift in author roles and in meaning-making. Pachler and Daly (2009) show how participation in these new technologies forces readers/users to establish their own narrative paths in what is essentially an unstructured and ill-defined world. Participating in blogs involves the complex sorting of non-linear and non-indexed information and the evaluation of reliability and validity of information, all within a loosely defined community. Pachler and Daly point out that “making sense of this across blogs makes considerable demands on the creative and semiotic work to be done by the user, where linked content requires the serial interpretation of images, language and content format, which can have little contextual continuity” (p. 9). Furthermore, they argue, blog creators assume that the reader can engage in the particular culture of that space and users must find their own way into the

creators' organization of their experiences and understandings. Signposts may exist, but there is no consistency from blog to blog, and users are constantly confronted with hyperlinks, sidebars, menus, blogrolls⁵, comment sections, and blogging threads that must be evaluated for relevance, importance, and readability. Pachler and Daly contend that the agency resulting from this for the reader/user can range from empowerment to exclusion.

Examining the epistemological implications of digitally-based learning raises the issue of digital literacy and its relationship to broader conceptions of literacy. Jewitt (2006) points out that there is considerable tension between the traditional language-focussed notions of literacy and the multimodal character of the new media, which emphasize the visual aspect of writing and mediate written text in a way that allows exploration of different and alternate layers of meaning, and which challenge the dominance of language. Important questions emerge. Is there a digital literacy or, more likely, are there digital literacies? If so, should they be examined as separate phenomena, viewed as a sub-set of literacy, or used to redefine the concept of literacy? The following section examines research addressing these questions.

Defining/Redefining Literacy in the Digital Age

Digital vs. print literacy. The concept of digital literacy, usually understood broadly as the ability to function effectively in digital contexts, is problematic in that it falls into the tendency identified by Merchant (2007) to use

⁵ lists of blogs recommended by the author

literacy as a vague metaphorical term to denote any “desirable and educable competence”, in this case in computer use. Eyman (2009) points out the need to distinguish digital literacy from general terms that imply mere tool use (e.g. computer literacy, electronic literacy) and overly narrow terms such as Internet literacy. Lankshear and Knobel (2006a) identify two categories of definitions of digital literacy: conceptual definitions such as those provided by Lanham and Gilster, and standardized sets of operations intended to provide normalizations. Lanham’s (as cited in Lankshear & Knobel, 2006a) definition of digital literacy is the ability to understand information in any form, including complex images and sounds, and the ability to move easily between mediums. Accordingly, individuals who are digitally literate are able to choose the form and media that are best suited to the knowledge they want to express and to the audience they want to reach. Gilster (as cited in Lankshear & Knobel, 2006a, p. 22) defines digital literacy as “the ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers”, with the components of knowledge assembly, evaluation of information, Internet search and hypertext navigation. Lankshear and Knobel (2006a) point out that what is missing in both these definitions is an understanding of the importance of social relationships.

Merchant (2007) has argued that we need a precise definition of digital literacy to identify specific skills needed to participate in digital communication, to fully benefit from the learning potential of practices such as social networking and collaborative knowledge building, and to develop critical digital literacy to engage

with the unregulated and increasingly commercial Internet. He proposes a narrower definition of digital literacy that clearly distinguishes it from the broader term “communication” by emphasizing the communication of meaning through written representation. While recognizing the interdependence of words, images and other elements in context, he argues that written information is still central to visual and multimodal texts and that it still plays a central role in digitally-mediated communication practices such as email, SMS, blogging, and social networking. Digital literacy, then, would be concerned with how we combine written representation with other forms of communication in multimodal texts, where context retains primacy. What is not clear in this definition is the precise nature of the relationship between digital literacy and literacy and, in particular, why digital literacy must be separated from the broader concept of literacy.

Questioning digital literacy. Eyman (2009) discusses the relationship between digital literacy and traditional print-based literacy practices: “Digital literacy... changes and transforms these practices when they are enacted in new media spaces; digital literacy practices are multimodal and recombinative, constantly reconfiguring themselves from the available modes and resources of the digital medium” (p. 10). To illustrate the complexity of the multimodal practices of digital literacy, he describes a student-designed digital exhibit that includes combinations of graphical representations such as logos and icons, visual elements such as colour scheme and font selection, text, sound, and interactivity (p. 15). In this view, digital literacy is understood as more than the enactment of traditional print literacies in a digital context; it contributes to our

understanding of how we construct meaning from visual representations of language and symbolic systems and how we manipulate digital objects. Eyman suggests the tension between print and digital literacy can be resolved by combining “the concept of literacy as socio-historically situated practice with a modifier that allows us to make a distinction between those practices that are culturally located within print media and those located within digital media” (p. 7).

Jewitt (2006) agrees, contending that rather than risk fragmenting the definition with terms such as digital literacy and visual literacy, we should redefine the term literacy in a way that highlights the multimodality of technologically-mediated learning:

Conceptions of literacy need to be expanded beyond language to all modes. The static notion of literacy as the acquisition of sets of competencies can be replaced with a notion of literacy as a dynamic process through which students use and transform multimodal signs and design new meaning. (p. 143)

Similarly, Bazalgette (2008) rejects the fragmentation of multiple (and inevitably separate and hierarchical) literacies in favour of a unified and coherent conceptualization that includes print literacy, media literacy and digital literacy:

Against the continuing multiplicity of claims for new ‘literacies’ such as digital literacy, internet literacy, games literacy, etc., I think we need to keep in mind that literacy is essentially about texts: that is, human communications in sharable, reproducible forms.... Indeed, I think it is confusing and unhelpful to use the term ‘literacies’: literacy ought to be the

whole portfolio of integrated skills, knowledge and understanding that enables us to participate in our culture and society. (p. 12)

She advocates re-establishing the central focus of literacy on the text, which she argues has always been multimodal, rather than placing emphasis on the platforms of the texts.

Clearly, tensions in the relationship between conceptualizations of digital and traditional literacies are far from resolved. However, as the following section demonstrates, there seems to be some agreement on the skills and attitudes that learners will have to adopt to participate successfully in digitally-based, and by extension, mobile learning.

Skills for Successful Participation in Mobile Learning

Literacy in the 21st century can be seen in part as the ability to navigate in a complex, ill-structured world with few sign posts (Brown, J.S., as cited in Brown, T. H., 2005) and the skills required for this navigation are varied and complex. Drawing on the work of Gilster and Goldhaber, Lankshear et al. (2000) have identified a list of skills that could form the basis of meaningful and successful participation in digitally-based learning such as mobile learning:

- the ability to find and use information that has not been filtered by acknowledged experts;
- the ability to make judgements about its credibility based on new criteria about how it was gained and how others have used it;
- the ability to distinguish between content and presentation in an economy based on attracting attention;

- the ability to gain attention by making new connections and new language moves in a context of relatively ubiquitous access to information;
- the ability to “read” multimodal texts that blend images and text in complex ways and that evoke emotion and sensorial responses that break down the primacy of propositional linguistic forms of truth bearing. (p.35)

A study of digital media and learning by Jenkins, Purushotma, Clinton, Weigel, and Robison (2006) identifies a similar but more specific set of essential literacy skills:

- play (the ability to experiment and solve problems);
- performance (the ability to assume alternate identities in immersive digital experiences);
- simulation (the ability to interpret and create complex dynamic models);
- appropriation (the ability to sample and remix content);
- multitasking;
- distribution cognition;
- collective intelligence;
- judgement (the ability to evaluate information sources);
- transmedia navigation (the ability to follow information across various modalities);
- networking (the ability to search, synthesize and disseminate information);
- negotiation (the ability to understand and respect diverse cultures and perspectives);
- visualization (the ability to interpret and create representations of data).

Unfortunately, such lists of skills and knowledge seem to lack analysis of the values behind them. The notion of multitasking, which appears in both these lists, is an example. Multitasking is defined by Lankshear and Knobel (2006a) as the ability to move fluently between online and/or digitally-mediated tasks and the demands of the physical environment. In a discussion of multitasking through digitally connected devices such as laptop computers and mobile phones in formal classroom settings, the authors state:

Effective multitasking is associated with greater efficiency, as well as with being digitally proficient.... Similarly, under conditions of intensified competition in the world of work, efficient multitasking becomes an important part of competitive edge. It seems very likely that the social, cultural and economic value and esteem associated with multitasking will increase in the years ahead, to the point of becoming the default mode. To this extent, responses like closing down on possibilities for multitasking might well prove in the relatively short term to be on the wrong side of history. (p. 60)

This approach seems to me too deterministic for educators; the corporate agenda values multitasking and online efficiency rather than embodied social relations and single-task reflection, so these are accepted as the new default, without questioning whose interests are served and whether the role of education should be to remain on this side of history in the short term.

Mobile Learning: Ready or Not?

The previous sections have laid out in some detail opportunities and literacy challenges posed by mobile learning. This review closes with a closer look at some the concerns raised by this discussion. Mobile learning is a new field that lacks a large body of critical scholarship. Extending the discussion to literacy in the new media in general may help us identify the risks of mobile learning, including its potential to contribute to a new digital divide.

Insider Mindsets and Disappearing Technology

Insider mindsets. Lankshear and Knobel's (2006a; 2006b) discussion of what they call the "new literacies" demonstrates some of the concerns about participation in mobile learning. They map out the tension between two separate mindsets, ways of seeing and responding to the world, associating the label "insider mindset" to those who function reasonably comfortably in the digital world that

... .privileges participation over publishing, distributed expertise over centralized expertise, collective intelligence over individual possessive intelligence, collaboration over individuated authorship, dispersion over scarcity, sharing over ownership, experimentation over "normalization", innovation and evolution over stability and fixity, creative-innovative rule-breaking over generic purity and policing, relationship over information broadcast, and so on.... (p. 21)

The question largely missing in the research reviewed here is who is likely to be able to adopt this insider mindset and who is likely to be sidelined by the

demands of mobile learning. Sims (2008) points out that if mobile learners are independent and nomadic, then they are also made responsible for developing the skills needed to function in the connected and collaborative network of people and technology. While this may be seen as the empowerment of learners, it may also be seen as the imposition of new literacy burdens, such as the need to be able to analyse and critique information that arrives in multiple and novel formats (Geddes, 2004) and, insofar as mobile learning involves global communication, the ability to negotiate cultural and linguistic diversity to arrive at shared meanings (Johnson & Kress, 2003). Furthermore, as Sims (2008) points out, the empowerment of learners introduces new literacy demands for teachers, who must participate in that same connected, collaborative environment with new skills, attitudes and values, not as holders of power but as valued holders of experience and knowledge. Finally, mobile learning introduces the potential for displacement of fixed curricula by those which arise from the interactions of connected learning, curricula that may be neither predictable nor testable (Sims, 2008).

Disappearing technology. Bruce and Hogan's (1998) ecological model of literacy provides a useful lens for this analysis because it places the discussion of literacy technologies in this socio-cultural context, recognizing that literacy technologies are ideological tools used to embody social values and, as part of an ecological system, must be understood in relation to larger systems and practices. The ecological model demonstrates how the integration of a new technology can lead to the identification of those who cannot master it as

disabled. This happens because, in our current ideological context, as technologies become fully embedded in our lifestyles, they become invisible. At the beginning of this process, the introduction of a new technology, any difficulty we have using it is blamed on the design of the technology. However, as the technology becomes so widespread as to make it compulsory (and invisible), difficulty using is attributed to a flaw or disability in the individual. Mobile devices, especially mobile phones, are now becoming or are already invisible technology (May & Hearn, 2005). However, difficulty using mobile technology persists and there is the potential for it to define a large section of our society as disabled. Kukulska-Hulme (2007) suggests that many users of mobile phones move on to new devices before they have really learned to use the ones they already have. Since, as she points out, little research has been done on how people learn to use mobile devices over time, we do not know how much of the population and which sectors of the population are at risk of being “disabled”. With the demands of these new literacies, there is a potential for mobile learning, if widely adopted, to contribute to a disparity between the so-called digitally literate and digitally illiterate.

Digital Natives and Digital Immigrants?

When concerns about training and implementation for mobile learning are discussed, they tend to be directed at training educational staff to use mobile devices effectively rather than at ensuring the full participation of learners (Naismith & Corlett, 2006; Kukulska-Hulme et al., 2009). This may be because much of the literature about mobile learning seems to take for granted that it will

be applied with learners who are already skilled in negotiating the digital world, i.e. youth and young adults. Prensky (2001), who is widely cited in mobile learning literature, calls them *digital natives* and claims that their constant exposure to digital media has given them brains that are physically different from so called *digital immigrants* and well-suited to learning in digital environments. However, his claims are not supported by any substantial evidence. Pachler's (2009) overview of the London Mobile Group's socio-cultural ecological approach to mobile learning⁶ provides a more nuanced view:

Young people can be seen to increasingly display a new habitus of learning in which they constantly see their life-worlds framed both as a challenge and as an environment and a potential resource for learning, in which their expertise is individually appropriated in relation to personal definitions of relevance and in which the world has become the curriculum populated by mobile device users in a constant state of expectancy and contingency. (p. 94)

However, here again no evidence is cited about how this new habitus of learning is actually being played out in the real world, particularly about which young people "increasingly display it" and which ones might be increasingly left behind.

There may be reason to question this conception of a generation of digital natives, especially if the definition of digital native includes the ability to move beyond mere consumption of information. For example, although a recent Pew

⁶ For a detailed discussion, see Pachler, N., Bachmair, B., Cook, J., & Kress, G. (Forthcoming).; Pachler, N., Cook, J., Bachmair, B. (Forthcoming).

report (Lenhart & Madden, 2005) found that more than half of young Internet users in the US were involved in the creation and sharing of online content, this number includes fairly low-complexity tasks also mastered by so-called digital immigrants, such as taking and sharing digital photos. When practices are broken down, the numbers for complex content creation fall considerably: e.g. 22% for creation of personal web pages, 19% for blogs, 19% for remixing of existing content. Selwyn (2007) claims that the passive retrieval of information is still the most popular online activity for youth in technologically advanced European countries and Kennedy et al. (2007) have found surprisingly low levels of meaningful participation in digital media in Australia.

A New Mobile Digital Divide?

Much has been written about the digital divide, most of it focussing on disparities in access to ICT based on geography, income, education, age and gender (Balnaves et al., Wresch, Jurich, & Parker as cited in Selwyn, 2007). Selwyn (2004) argues that this discussion of the digital divide is based on a theoretically shallow conception of dichotomous “haves” and “have-nots” identified by a simplistic definition of access. Evaluating access to information technology, he argues, means separating formal (physical) access and perceived (effective) access in practice, as well as simple use of IT from meaningful engagement, in which there is “a degree of control and choice over the technology and its content” (p. 349). According to Selwyn, the ability of individuals to move from mere physical/theoretical access to meaningful engagement with information and communication technology is constrained by

their economic, cultural, social and technological capital. Applied to mobile learning, Selwyn's analysis reminds us that it will not be enough to ensure that individuals are able to own, rent or borrow mobile technology regardless of gender, age, education, economic situation, and location. For mobile learning to be meaningful, individuals must feel able to use the technology, they must have opportunities to use it in appropriate contexts (e.g. at home or at work rather than in a public place), and they must have the social and cultural resources they need to develop and sustain meaningful engagement.

Conclusion

The research reviewed here suggests that the definition and theories of mobile learning should focus on mobility of learning context (Sharples et al., 2006; Wali, Winters, & Oliver, 2008; Kukulska-Hulme et al., 2009), where the context is technologically mediated and primarily digital (Alexander, 2004; Taylor et al., 2006; Sims, 2008; Traxler, 2009b). Understanding the literacy implications of mobile learning, then, requires an understanding of the social, cultural and epistemological challenges of digital contexts. Among other things, learning in digital contexts requires familiarity with the social practices and metaknowledge of online cultures (Lankshear & Knobel, 2006a) and the ability to negotiate and manage online identity(ies) and to control privacy (Boyd & Ellison, 2008). It represents significant changes in how we define and use knowledge (Lankshear et al., 2000; Kress, 2000a; 2000b; Lankshear, 2003; Kress & Pachler, 2007; Kress, 2008), calling on learners to function in contexts that are unstable, provisional and contingent (Kress, 2000a; 2008) and to navigate the increasingly image-based and multimodal nature of online texts (Lankshear et al., 2000; Kress, 2003; Jenkins et al., 2006). To do this, learners will have to be able to access, assess and use knowledge from a variety of sources without the guidance of experts (Lankshear et al., 2000; Jenkins et al., 2006).

Mobile technology, especially the mobile phone, is already so embedded in our lives that it meets Bruce and Hogan's (1998) definition of an invisible technology. A widespread push for mobile learning increases the risk that this technology will become compulsory at a time when many older learners are not

ready to use it effectively (Kukulska-Hulme, 2007), when even so-called digital natives may be limited in their participation to passive consumption (Selwyn, 2007), and when teachers may not be prepared to help learners engage with it in meaningful ways (Sims, 2008).

The potential of mobile learning rests on a number of assumptions that need a more critical examination. How many young people have the attitudes and abilities required for participation that transcends passive consumption? Where this agency exists, is there evidence that they will apply it to formal learning? How will we help the so-called digital immigrants overcome the technological, social and cultural barriers to meaningful participation? How will educational institutions, already struggling to adapt to the world of tethered digital technology, cope with the new demands of mobile learning? If we are to begin to address these questions, much more work must be done on the social, cultural and epistemological, i.e. the literacy challenges, of mobile learning.

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