M-Learning: The Educational Use of Mobile Communication Devices

Paul Birevu Muyinda, Ezra Mugisa, Kathy Lynch

This is a position paper which explores the use of mobile communication devices in teaching and learning. We especially undertake a crosswalk around the fast evolving field of mobile learning with a view of positioning it as a new paradigm for learning. We deduce that successful development and implementation of any mobile learning solution requires a deep understanding of the learning environment which is greatly influenced by the learners’ learning styles, theories behind m-learning, the technology at play and the institutional/organisational culture. Interplay of all these factors enables the contextualization of learners and provides a learner centered learning environment. We eulogize the need to blend mobile with fixed communication devices in order to bridge the digital divide in electronic learning and finally conclude that mobile technological innovations per se are not enough to propel mobile learning but a match in growth need to be realised in the mobile learning pedagogies, theories, philosophies and organisational attitudes towards its use in education.

Introduction and Background

The use of mobile communication devices in education has led to the evolution of a new paradigm in electronic learning (e-learning) called mobile learning (m-learning). M-learning, is a form of e-learning that specifically employs wireless portable communications devices to deliver content and learning support (Brown, 2005) [4]. Advances in mobile computing and handheld devices (ipod, cell phones, smart phones, PDA, notebooks, etc), intelligent user interfaces, context modelling, wireless communications and networking technologies (WI-FI, Blue Tooth, GPS, GSM, GPRS, 4G) have precipitated mobile learning (Sharples, 2000 [30]; Knowledge Anywhere, 2002) [15].

M-learning is gaining prominence because of the increasing desire for lifelong learning which is usually undertaken by learners with other life obligations related to work, family and society. Such learners are constantly on the move and require devices that facilitate learning on the go. Typical e-learning systems have failed to provide on-the-go learning because they are usually situated in fixed environments (Woukeu et al., 2005) [36]. They are tailored toward PC based web access and are not customized for mobile devices (Goh and Kinshuk, 2006) [11]. Hence m-learning comes in handy to support the on-the-move learner.

M-learning just like its parent field, e-learning, has not fully matured. Consequently, m-learning is attracting considerable research (Woukeu et al.,
Unfortunately, research in young fields has been criticised for lacking appropriate theories and clear epistemological stand viewpoints (Mitchell, 2000) [23]. As an evolving research area, many fundamental issues in M-learning are yet to be exhaustively covered (Goh and Kinshuk, 2006) [11]. Such fundamental issues have been identified by Conole (2004) [6]. According to him, new learning technologies are best appreciated if one can understand the technology at play, learning styles of the technology users, the pedagogical aspects of using the technology for teaching and learning and organizational or institutional attitude towards the technology. Goh and Kinshuk (2006) [11] are in consonance with Conole (2004) [6] as they re-emphasise the need for further research in pedagogical practices generated from simple wireless and mobile technologies. It is therefore evident that the design and implementation of m-learning applications has not stabilised since its theoretical and philosophical underpinnings are just in the making. We use Conole’s (2004) [6] prerequisites for introducing new learning technologies to explore the possibilities and challenges of integrating mobile communications technologies into the teaching and learning process. Our position is based on works around mobile communications devices for learning, m-learning and learning styles, m-learning theories, mobile technological innovations and learning, organizational culture and m-learning, challenges to m-learning and future projections for m-learning.

Possibilities of mobile communications devices for learning

We use the phrase mobile communication devices to refer to those wireless communication devices that can be used while on-the-move. These devices provide “wearable computing environments” (Sung et al., 2005, pg 2) [32]. They come in a multitude of models, sizes, capabilities and purposes (Attewell, 2005) [2]. Mobile phones, smart phones, PDA, iPods, notebooks and zunes are examples of such devices. Their permeability varies from country to county and from one economic class to another. However, the ownership of the mobile phone has been democratised as a wide spectrum of the populace, irrespective of race, economic status and country, have embraced its use (Prensky, 2004) [29]. The mobile phone is a necessary device of life (Muyinda, 2007) [26].

Apart from contributing to their orthodox purpose of communication, these devices are widely being used in commerce and entertainment (Keegan, 2005) [13]. The iPod, for instance, is a great source of entertainment for both the digital natives and migrants. High end mobile phones are now being used to access Internet and a number of organisations have developed mobile phones applications (Sung et al. 2005 [32]; MobiLearn, 2005 [25]; Goh and Kinshuk, 2006 [11]; Thornton & Houser, 2005) [33]. This has been induced by the capabilities of mobile phones and their widespread acceptability and permeability. By 2004, there were 1.5 billion mobile phones in the world, a number which was three times the number of PCs (Prensky, 2004) [29]. The growth in number has equally been matched with growth in processing capacity. The processing capacity of high end phones
is comparable to that of mid 1990 PCs, a capacity which was required to land the spaceship on the moon in 1969 (Archibald, 2007) [1]. This processing power has provided an impetus for use of mobile phones in education. Therefore the bulky of this paper is concentrated on the mobile phone as a tool for m-learning.

Several large scale initiatives for example MobiLearn (MobiLearn, 2005) [25], MLearning (MLearning, 2005) [24] and From e-Learning to M-learning (Ericsson, 2002) [8] have been investigating the potential benefits of this new pervasive approach to learning. An m-learning survey in UK’s schools and higher education has suggested that young adults (16-24) are switched onto learning by mobile phones and PDAs (LSDA, 2003) [18]. Goh and Kinshuk (2006) [11] have cited several m-learning initiatives including games-oriented implementation for m-portal (Mitchell, 2003) [22]; class room of the future (Dawabi et al., 2003) [7]; hands-on scientific experimentation and learning (Milrad et al., 2004) [21]; mobile learning system for bird watching (Chen et al., 2003) [5] and context-aware language learning support system (Ogata and Yano, 2004) [28]. At Kinjo Gakuin University in Japan, mobile phone have been used in the teaching and learning of English language (Thornton & Houser, 2005) [33] while at the University of Pretoria, m-learning has been used for extending administrative support to distance learner (Brown, 2005) [4]. Reminders for critical dates and events are sent to distance learners as SMS messages, snippets of audio messages are recorded on telecommunications companies’ servers for students to call in and listen, textual study materials are augmented with short objective type questions that students are required to answer with real-time feedback being provided. Attempts are being made to have content delivered on mobile communications devices but with little pedagogic practices (Sung et al., 2005) [32].

Goh and Kinshuk (2006) [11] have identified several other applications of m-learning. For instance, through the use of interactive games and contests installed on mobile devices, learners can construct their own knowledge and share among themselves. In the classroom, m-learning integrates with online learning management systems to provide tools for brainstorming, quizzing, and voting. In the laboratory, m-learning supports individual learning as well as collaborative learning. Mobile devices can be of benefit to laboratory environments for data gathering and control. In field trips, mobile devices support learning by collecting pictorial and textual data. Their mobility enables learning to take place in the field. In distance learning mobile devices support the delivery of synchronous and asynchronous learning while in informal settings the devices support incidental and accidental learning. M-learning supplements formal learning and teaching.

As already alluded to mobile communications devices come in variety of sizes, types, designs and models. The varied designs are meant to cater for varied customer tastes. Attewell (2005, pg 2) [2] confirms thus:

The modern mobile phone market caters for a wide variety of customer tastes and lifestyles. Some phones are tiny and discrete, some are chosen for their appearance (like a fashion accessory, with alternative covers that allow that appearance to be
changed to match the owner’s outfit), some just offer basic functionality while some others provide a wide range of business and leisure services to their users. Manufacturers are marketing diverse product ranges, including devices that specialize in providing particular services or are aimed at particular users. Instead of describing a product as a mobile phone, manufacturers often use descriptions like ‘game deck’, ‘communicator’ or ‘mobile multimedia machine’.

This implies that applications designed for use on mobile phones must take cognisance of user preferences. In teaching and learning, the application should conceptualise the learner (Conole, 2004) [6] and take care of the different learning styles and learning preferences.

**M-learning and learning styles**

Learning is the process of retaining/remembering and understanding the material in order to implement it (Muyinda, 2007) [26]. The philosophy underpinning the design and implementation of an online course recognizes the need for: a conducive learning environment, dedicated blocks of time on the part of the learner for e-learning, course developers focusing on the course’s main objective, targeting users’ profiles, defining the course level, repetitions to allow concepts to sink and be learned, having an engaging presentation, hands-on participation/practice, immediate feedback and evaluation (Mescan, 2006) [20]. M-learning can particularly enable repetition of facts, immediate feedback and evaluation, and can actively engage learners as it emphasizes learner centeredness.

Further, the hands on practice enable experiential learning as is espoused in Kolb’s (1984) [16] experiential learning theory. According to this theory, ideas are not fixed, but are formed and modified through the experiences we have and by our past experience, hence making learning process cyclic in nature. M-learning can abet Kolb’s (1984) [16] cyclic learning process in which the learner working from his/her experience can come up with several reflections that can be used in formulating new theories which he/she can experiment with in order to get new experiences (Figure 1). Whenever, we travel from one location to another, we gain different experiences which we can record on our mobile devices and reflect on when conceptualizing new theories that we later experiment with to gain further experience.

**Fig 1:** Learner contextualization (Honey and Mumford, 1982 [12]; Kolb, 1984 [16]; Wolf and Kolb, 1984 [35]; McKimm, 2002 [19])
McKimm (2002) [19] strengthened Kolb’s learning cycle by identifying the learning abilities needed at each point of the cycle. He (McKimm, 2002 [19]) contends that the learning cycles require four kinds of abilities, namely:- i) concrete experience - where learners are enabled and encouraged to become involved in new experiences; ii) reflective observations - where time must be availed to learners to be able to reflect on their experiences from different perspectives; iii), abstract conceptualization where learners must be able to form and process ideas and integrate them into logical theories; and iv) active experimentation where learners need to be able to use theories to solve problems. A community of practice sending educative SMS messages to each other via a mobile phone is likely to benefit from the aforementioned abilities (Figure 1).

Learning abilities have been strongly associated with Wolf and Kolb’s (1984) [35] learning styles namely: the accommodator, diverger, assimilator and converger. These have been juxtaposed in the learning cycle in Figure 1. The accommodator carries out plans and tasks that involve them in new experiences, the diverger has good imaginations and generates new ideas, the assimilator creates theoretical models and makes sense of disparate observations while the converger applies ideas in a practical way. These styles march Honey and Mumford’s (1982) [12] categorization of learners as either activists or reflectors or theorists or pragmatists. The activist responds most positively to learning situations that offer challenge and which include experiences and problems, the reflector responds most positively to structured learning activities in which time is provided to think, the theorist responds most positively to logical, rational structure and clear aims, and pragmatist responds most positively to practically based immediate relevant learning activities which allow them to practice and use the theory. These are also mapped onto the learning cycle in Figure 1. Understanding the different learning styles and abilities enables the formulation of an all inclusive m-learning theory.

**M-Learning Theories**

Literature indicates lack of m-learning theories, but grounds are being prepared for their development. Sharples et al., (2005) [31] have suggested four pre-requisites for the formulation of an m-learning theory. The first pre-requisite requires one to distinguish between what is special about m-learning vis-à-vis other types of learning. The second pre-requisite is to determine the amount of learning that occurs outside the classroom with a view of m-learning embracing it. Vavoula (2005) [34] in a study of everyday adult learning discovered that the majority (51 percent) of learning episodes took place at home or at place of work - learners usual environment, 21 percent - outside the office, 5 percent - outdoors, 2 percent - in friend’s home, 6 percent - place of leisure, 14 percent - places of worship, the doctor’s room, cafes, hobby stores and cars. Only 1 percent occurred on transport. The learning occurring on transport suggests that m-learning is not necessarily associated with physical movements. The third pre-requisite is the need to bear in mind the contemporary accounts of practice such as learner centeredness,
knowledge centeredness, assessment centeredness and community centeredness. The fourth pre-requisite is that an m-learning theory must take account of the ubiquitous use of personal and shared technology. This negates Keough’s (2005) [14] pessimism about the working of m-learning arising from its association with the ever changing mobile technology.

Sharples et al., (2005) [31] enlist questions to provide a criterion against which an m-learning theory could be tested. Is it significantly different from current theories of classroom, workplace or lifelong learning? Does it account for mobility of learners? Does it theorize learning as a constructive and social process? Does it analyse learning as a personal and situated activity mediated by technology? A clear distinction between classroom and mobile learning ought to be drawn. Vavoula (2005) [34] reports that the MobiLearn European project while reflecting on formulating a theory for m-learning identified that: it is the learner who is mobile rather than the technology, learning is interwoven with other activities as part of everyday life, learning can generate as well as satisfy goals, the control and management of learning can be distributed, context is constructed by learners through interaction, m-learning can both complement and conflict with formal education, and that m-learning raises deep ethical issues of privacy and ownership.

In absence of concrete theoretical underpinnings for m-learning, existing theories can be harnessed to provide a rich learning experience in M-learning. Naismith et al. (2004) [27], have, during their review of M-learning literature, proposed to solve the dearth in m-learning theories by considering new practices against existing learning theories - behaviourist, constructivist, situated, collaborative, informal and lifelong learning theories.

The behaviourist learning theory emphasizes activities that promote learning as a change in learner’s observable actions. The learning should invoke a stimulus and a response. In the case of m-learning, an SMS message, for example, invokes a stimulus which may lead to an action as a response.

The constructivist learning theory emphasizes activities in which learners actively construct new ideas or concepts based on both their previous and current knowledge. With a mobile phone learners can construct their own knowledge and share it freely with peers at anytime in any place. This in m-learning is referred to as ‘participatory simulations’ (Naismith et al., 2004) [27].

The situated learning theory emphasizes activities that promote learning within an authentic context and culture. Mobile devices are especially well suited to context-aware applications simply because they are available in different contexts, and so can draw on those contexts to enhance the learning activity.

The collaborative learning theory emphasizes activities that promote learning through social interaction. Through conversations on mobile phones collaboration can be enhanced.

The informal and lifelong learning theory promotes activities that support learning outside a dedicated learning environment and formal curriculum. Mobile
technologies can support informal learning which may be intentional or accidental (Sharples, 2000) [30]. Intentional learning may be acquired through, for example, intensive, significant and deliberate learning efforts, while accidental learning may be acquired through conversations, TV and newspapers, observing the world or even experiencing an accident or embarrassing situation. As was found by Vavoula (2005) [34], the majority of learning episodes in adults is informal. Continuous innovations in mobile communications technology are precipitating informal learning.

Mobile Communications Technology Innovations and Learning

The hype usually attached to new learning technologies often shoots the technology in its own foot as critical issues related to its “usability, flexibility and extensibility are often over shadowed by the need to quickly demonstrate the new features of the technology” (Sung et al., 2005, pg 1) [32]. Hence new technologies are embraced on the surface with no deep understanding of their fullest potentials (Graham, 2004) [10]. M-learning being a young field, its impact and capabilities have not been fully explored. It is well known that most computer users exploit only a small proportion of the technology available to them, and that immensely powerful machines are often used as little more than hi-tech typewriters and calculators. Keegan (2005) [13] has observed that the mobile phone has been around for a couple of years with little regard to its potential for learning.

For an innovation which necessitates technological change and social re-organization, Graham (2004) [10] proposes a framework to answer questions such as: i) What the anticipated benefit of the innovation will be and whether there will be genuine additional benefits; ii) whether the chance of its being implemented successfully is much higher than the chance of its failure; iii) what the cost of its introduction would be in terms of disruption to existing systems that are known, tried and reliable; iv) how stable the circumstance in which the proposed innovation is to be made; and v) whether there are recurrent patterns of behaviour that would give some pointers to its likely reception?

Relatedly, Conole (2004) [6] while considering underpinning technology of e-learning also asks questions such as: i) what are the new and emerging technologies and how can they be used to support learning and teaching? ii) What learning platforms are being used and how do they compare? iii) What are the emerging new software and hardware systems? iii) How can we explore mobile and smart technologies? and iv) What ways are in-built tracking mechanisms within m-learning systems giving rise to surveillance issues?

These questions bear directly on the lives of people for whom the innovation is intended. These questions ought to be answered before undertaking any new technological innovations. IT projects have been undertaken whose results have not benefited the intended users. Care ought to be taken because; in the name of technological improvement, a huge cost in terms of personnel as well as money can be incurred by an organisation quite pointlessly when all conditions in the organisation are not favourable for m-learning.
Organizational culture and M-learning

Lee (2003) [17] observes that an information system is not the information technology alone, but the system that emerges from the mutually transformational interactions between the information technology and the organization. This implies that innovations in mobile technology per se can not propel m-learning. There must be a positive organisational attitude towards the technology and the people in the organisation must be enabled to use the technology. Hence, to effectively use m-learning in an organization, m-learning system designers need to understand: i) how the different stakeholders (academics, support staff, administrators, senior managers and students) currently work; ii) the mechanism and procedures for developing shared knowledge banks of expertise and information; iii) the need to outline roles and responsibilities for m-learning activities - management, technical, research, dissemination, evaluation and training; iv) the different views to m-learning and its role - academics vs. support staff; v) how the institution divides roles and the responsibilities for m-learning; and vi) how much training and support the staff are to get (Conole, 2004) [6].

Challenges to M-learning

Keough (2005) [14] is pessimistic about the functioning of m-learning. Keough (2005) [14] has advanced seven reasons as to why m-learning will not work. According to him m-learning as a concept alone is doomed to failure because as a learning model it appears:

- To be technology driven: M-learning alone is a technology driven concept
- Not cogniscent of market usage: We know too little about what mobile devices are used for
- Yet to adopt discoveries in Cyber psychology: We know too little about flow and learning relationships/Networks or the Transactional Analysis of Mobile Relationships
- Not to change entrenched institutionalised education Models: Cultures of education and communications reflect government control measures
- To rely on nascent consumer technology: Mobile devices are inherently dissatisfying by never quite meeting every promised need for the consumer.
- To be short on standards to overcome cultural differences: while standards are slow to emerge governments are rapidly regulating and limiting the use of mobile communications technology
- To lack a mobigogy: teaching and learning models are needed

--- Keough (2005, pg 1) [14]
Others such as Boone (2007) [3] cite examination malpractices as one of the challenges that will make the wearable technologies not desirable for learning especially among administrators of educational institutions.

...schools [in the US] started banning cell phones, realizing students could text message the answers to each other. Now, schools across the country [US] are targeting digital media players as a potential cheating device. ...Devices including iPods and Zunes can be hidden under clothing, with just an ear bud and a wire snaking behind an ear and into a shirt collar... Some students use iPod-compatible voice recorders to record test answers in advance and play them back (Boone, 2007, pg 1) [3]

With such developments in the minds of school/college/university administrators, it will take considerable effort to lobby for the acceptance of the mobile phone or any other wearable communication gadget as a tool for learning. Where they have to be accepted, considerable restrictions will have to be imposed, sometimes to the detriment of learning.

Another challenge to m-learning stems from the habit of showcasing new communication technology as a learning tool. In many instances, efforts are mainly concentrated on delivering content to these mobile devices with little consideration to the rich potential for more interactive learning paradigms (Sung et al., 2005) [32]. These showcases usually over shadow practical issues related to usability, flexibility, and extensibility in favor of quickly demonstrating the new features of the technology. This, in most cases deals a killer blow to m-learning adoption.

The pessimism resulting from the challenges identified here and elsewhere is uncalled for. The World is dynamic. Technology, cultures, teaching and learning models, methods, just to mention but a few, are not static. M-learning just like any immature field requires time to grow and to be understood. Besides, advocates for m-learning recognize the fact that it can not be used alone in its entirety (Brown, 2005) [4]. It has to be blended with other methods of delivery including face to face, print and online learning if the digital divide is to be bridged. With ubiquitous computing in sight, we can not delineate our selves from m-learning (Muyinda, 2007) [26]. It will only require time to have solutions devised for its productive use.

However, the truly big challenge for the educators and technology developers of m-learning is to find ways to ensure that this new learning technology is highly situated, personal, collaborative and long term; in other words, truly learner-centred learning.

Future Projection of M-learning

The future of m-learning is forecasted to be bright. The capabilities of mobile phones, PDAs and smart phones are always on the move to higher ends. Research endeavours in this field are magnanimous (Woukeu et al., 2005 [36]; Goh and
Kinshuk, 2006 [11]). Integrated context-aware capabilities will transform everyday activities by providing the ability to capture details about the time, location, people around you and even the weather (Naismith et al., 2004) [27]. The entire internet will become both personal and portable. Such technologies will have a great impact on learning. Learning will move more and more outside of the classroom and into the learner’s environments, both real and virtual and the m-learning is well positioned to champion these innovations.

As such research into m-learning is leaning towards m-learning in games and competitive learning, classroom learning, laboratories learning, field trip learning, distance learning, informal learning, m-learning pedagogy and theories, learning and teaching support, m-learning architecture and m-learning evaluation, requirements, and human interface (Goh and Kinshuk, 2006) [11].

Conclusion

The need to utilise previously unproductive time in our daily lives and the need for lifelong learning can not be overemphasised (Geddes, 2004) [9]. Advances in mobile communications technology have provided necessary conditions for m-learning. Mobile communication devices are capable of abetting independent learning for learners with different learning styles as it provides access to learning during previously unproductive times, it allows for more flexible and immediate collaborative options, it allows for controlled learning in contextual situations, and provides greater options for teachers to observe and assist in independent learning. Successful development and implementation of any mobile learning solution however, requires a deep understanding of the learning environment.

References


