REVISITING THE ‘M’ IN M-LEARNING: MAKING THE MOST OF MOBILE ENVIRONMENTS FOR TEACHING AND LEARNING
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Abstract
Educational innovations in developing countries are expanding due to pressure to achieve quality outcomes at scale and changing markets, where mobile devices are increasingly affordable. m-Learning as a concept has existed prior to the acceleration of these forces, but has gained increasing attention because of them. Growth in mobile phone ownership in developing countries has made mobile-phone enabled education (a form of e-learning) commonplace in formal and informal education. This paper draws on a broad review of existing m-learning programs to illustrate how instructional strategies are being employed, and explore whether these strategies are appropriate for learners in these contexts. It urges thinking differently about the ‘m’ in m-learning, and moving the conversation away from broad notions of mobile learning for any and all purposes to more detailed guidance on how to implement mobile learning from an informed pedagogical perspective that includes attention to local cultures.

Keywords: m-learning, education, development, culture, ICT

Introduction

ICTs and mobile learning in development
Technocentric tendencies have always been present in education, from the emergence of television broadcasting, to computers, to Internet and now handheld devices. The characteristics of modern technology—powerful analytical and computing capabilities; nearly unlimited storage capacity; interactive, visual and auditory stimuli; and the potential to connect people and resources with each other across time and place, to name just a few—have each, in turn, appeared intuitively beneficial for all types of education. Despite widespread adoption, no form of technology has yet proven to be a magic bullet, and quality education remains possible without technology; however, high achievement has typically been associated with high resource contexts, where there are highly trained teachers, supportive parents, a variety of instructional materials and regular presence on the part of students. These are factors that are missing from many developing country contexts, and where educators apply new technologies in the hopes of overcoming such barriers in support of the above-mentioned goals.

Among the latest developments in the field of educational technology are mobile devices and mobile learning (m-Learning) approaches that make use of mobile and portable technologies such as phones, tablet computers, low-cost laptops, e-readers, portable audio and video players, and custom mobile devices for specific purposes. Mobile learning in international development is not a new concept, although it is getting increasing attention as mobile devices become more pervasive, more powerful and more affordable. m-Learning continues is common across subject areas in higher education and workplace training in the developed world, and is increasingly being adopted for informal adult learning and service delivery (i.e., banking, accessing health or agriculture information) in the developing world. Initiatives are expanding due to the influence of major international organizations and donors, as well as private sector companies—notably telephone manufacturers. For example, UNESCO, in partnership with the Finnish mobile phone manufacturer Nokia, launched the Mobiles for Development Working Group, which organized two major m-learning events in 2011 and 2012 and authored 6 working papers describing the use of mobile phones for learning and teacher training around the world. Since 2011 a ‘mobiles for education for development’ symposium has been sponsored each year by the United States Agency for

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International Development (USAID) through an expanded “mLearning Alliance” focusing specifically on the use of mobile technologies for basic education. Additionally, the German development agency, GIZ, commissioned a paper on mobiles and numeracy (Strigel and Pouzevara, 2012). GSMA has been a major contributor to the m-learning agenda; the GSMA’s Development Fund has authored or sponsored several influential reports on mLearning in 2010 and 2012 (GSMA, 2010; GSMA, 2012; McKinsey & Company, 2012).

Drivers of m-learning adoption

The reason for acceleration of interest in m-Learning by development agencies and international institutions largely coincides with the explosion of mobile phone ownership in the developing world. As implied just by the title of the GSMA report “mLearning: A Platform for Educational Opportunities at the Base of the Pyramid” (GSMA, 2010) the phone is particularly suitable as a tool for accessing the populations with the greatest needs who are otherwise marginalized from traditional forms of education. The GSMA case studies repeatedly refer to access considerations before pedagogy. With costs decreasing and mobile phone ownership increasing, it is natural to wonder how one can capitalize on widespread access in order to reach populations in need of information and training, and publications such as this one consistently emphasize this driving factor.

While in development circles m-learning may be focused on access to learners through their mobile phones, in academic circles the focus of m-learning has been on the mobility of the device, and the types of learning opportunities that become available to everyone when learning can be done while on the move. Sharples et al. (2007) conceptualized m-learning as taking advantage of user and device mobility for facilitating learning across multiple contexts using active exploration and communication (“conversations”). This goes far beyond eLearning, or simply delivering the same content on a different—a mobile—device.

Categorizations of the benefits or opportunities of m-learning abound, and most likely include some of the following elements: accessibility (access to learning opportunities, content, experts/mentors, other learners); immediacy (on-demand learning, real-time communication and data sharing, situated learning); personalization (bite-size learning on familiar devices; promotes active learning and a more personalized experience); and intelligence (advanced features make learning richer through location-aware features, data capture, multimedia).

Though the potential for m-learning has been widely documented, the development of practical and effective learning environments that maximize the use of mobile devices and respond to real teaching and learning needs with appropriate pedagogies remains a challenge (Alvarez, et al. 2011). It is not enough to depend on the possibilities and potentials of the technologies to transform learning; it is also imperative to identify pedagogically sound learning models and environments (Brown, 2005).

About this paper

The purpose of this paper is not to add yet another definition or categorization of m-learning opportunities and benefits, drivers or success factors. Rather it is to accept that these benefits are widely and convincingly noted, and instead to reframe the discussion around how to develop and deliver mobile content that is effective and engaging by looking at the characteristics that mobile devices offer as well as proven pedagogies that are compatible with those characteristics. In this way, the rationale of accessibility doesn’t disappear, but rather is strengthened by a rationale of effective pedagogy.

The affordances of mobile devices, when examined first independently of content, suggest a number of new ways to think about the “m” in m-learning: micro-learning, multimedia learning, motivated learning, mutually collaborative (and even massive) learning and monitored learning. In this way, we can move the conversation away from broad notions of mobile learning for any and all purposes to more specific guidance on how to implement mobile learning from a pedagogical perspective.

The 5 “M’s”: Instructional approaches to mobile learning
Microlearning

Microlearning is a theory of instructional design that suggests that people learn more effectively if information is delivered in small units that are easy to understand and apply (Habitzel, et al. 2006; Hug, 2010). The characteristics of m-learning delivery—using small, connected mobile devices independently of classroom time, space, and teachers—and the added value outlined above (accessibility, personalization, intelligence, and immediacy), lend themselves to a microlearning perspective for content delivery and skills development.

From a content perspective, delivering only small units of learning at once is the most feasible way to deliver any content at all on many mobile devices—especially in developing countries—given bandwidth limitations, cost of data transfer, SMS character limits, and screen sizes. From a skills development perspective, the timing of such micro-units of learning is important for encouraging ‘anytime, anywhere’ learning, and situating it within the environment where learning will need to be applied later. There is also a cognitive basis for microlearning, and a similar instructional model known as ‘spaced learning’. The latter argues that information can be embedded into long-term memory through rapid, structured repetition separated by short breaks (Bradley & Patton, undated). It is these pauses in the learning process that appear to be the key factor in retaining information, particularly when the new information is followed by activities that stimulate certain senses or emotions (Douglas Fields, 2005; Abadzi, 2006).

Although spaced learning and microlearning are strategies used in traditional classroom teaching, they are also particularly suitable as models for mobile learning outside of the classroom. This m-learning model was tested in Bangladesh by Pouzezvara and Kahn (2007) using SMS and telephone conference calling to deliver the equivalent of a two-week face-to-face training program over 6 months at a distance. Results using pre- and post-tests compared to those of a control group showed trainees improved their scores in both Bangla and math after the training program as well or better than the control group peers, and trainees preferred the school-based option. More recently, programs such as BBC Janala, Mobilink, and MobilTrain, and programs implemented by UNESCO and Nokia in Nigeria and RTI International in Uganda and Malawi have incorporated this strategy of reaching out to teachers through SMS messaging or content accessed on the SIM card of the phone.

This concept of situated, just-in-time microlearning enabled by mobile devices is also demonstrated by widespread examples of “professional development, procedural support and decision support” (GSMA, 2010) services such as Nokia Life or Voxiva, which deliver daily messages about health and lifestyle to subscribers on their mobile phones. GSMA (2010) reports that the most common learning area rolled out or supported by multinational organizations at the time of the report was language learning (p. 25). Additionally, quiz-based programs for review and test preparation at all ages are a popular adaptation of microlearning, and constitute some of the biggest and most well-documented m-learning initiatives in the developing world (Nokia MoMaths, Kenya’s M-Prep, Nigeria’s EFIKO). While most experimental research on the effect of using SMS prompts to provoke behavior change come from the health sector, two examples are available of using SMS to deliver short, daily bursts of content to support reading instruction in developing countries. MobILiteracy Uganda (Pouzezvara, Pflepsen and King, 2014) and SMS Story in Papua New Guinea (Kleebu, et al., 2013) both showed positive effects on student outcomes when a facilitating adult (parent, in the case of Uganda, or teacher, in the case of Papua New Guinea) received explicit, daily instructional content to share with the learner. The SMS essentially supports the spaced, microlearning, by reminding someone to teach it every day.

The intersection of mobile learning with microlearning therefore implies revisiting training programs and their content and attempting to sequence and deliver that content more appropriately into its micro units. These micro units would be designed to be accessed at the convenience of the learners or at a time when the learner can best act upon the content, and as such, more fully internalize the information.

Multimedia

Multimedia strategies for learning are the product of years of experimental research due to the influence of technology in education programs beginning as early as the 1980s, when the
focus shifted from learning about computers to learning with computers. Mayer’s research, for example, (Moreno & Mayer, 1999; Mayer, 2009) has provided evidenced based strategies to support multimedia instructional design based on cognitive principles such as “contiguity” (“the effectiveness of multimedia instruction increases when words and pictures are presented contiguously in time or space” [Moreno and Mayer, 1999, p. 358] and “modality” (“when giving a multimedia explanation, words should be presented as auditory narration rather than as visual on-screen text” [ibid, p. 359] ) These dual presentation modalities increase working memory capacity by activating both auditory and visual cues, but the corresponding graphic and text materials should be integrated on screen as much as possible.

In the context of international development, and particularly teacher training through open and distance learning, Burns (2011) also cites the value of this cognitive principle of dual coding as well as addressing teachers’ individual learning styles through various ways of presenting information as a combination of text, audio, video, color and animation. Abadzi (2010) argues that real behavior change can best be brought about by using video to develop “automaticity in teaching skills” which minimizes extraneous cognitive load and allows teachers to focus on more reflective practices. The use of video for microteaching has been common practice for many years in teacher training programs in developed countries. Now, mobile, digital recording devices and portable USB projectors have made this method more accessible to teachers and teacher trainers in developing countries. Davidson (2011) and Dowrick (2011) describe how clips as short as 30 seconds to 3 minutes long prepared using simple ‘flip’-type cameras were sufficient to demonstrate “pivotal” teaching behaviors in a trial in Liberia using an approach known as “feedforward” (Dowrick, et al 2006). A pilot in Malawi tested the feasibility of using a portable MP3 player to support pre-service teachers in an open and distance learning training program. The devices were loaded with five weeks of lessons consisting of one or two readings, two videos, and an assignment directing the learner to complete tasks and document their completion using the camera and recorder features of the MP3 player. The results indicated through teachers’ self reporting that this was a feasible alternative to radio, that it encouraged peer-to-peer collaboration as well as independent learning on-demand (Carrier, 2011). Other forms of multimedia remain largely untested in teacher training (such as “apps”, games, or computer-based learning—including tablet mobile tablet computers).

New advances in technology and increasingly affordable devices are changing the way traditional interactive radio instruction (IRI) is being delivered, making it more interactive and truly ‘multi’media by combining radio broadcasts with phone-in or text messages to the show, for example. IRI can also be more mobile now that radio broadcasts can be recorded and stored on digital media players, overcoming the constraints of poor audio quality or inconvenient of radio broadcasts. Outside of teacher training, multimedia can also support classroom teachers who suffer from a lack of printed teaching aids such as books, posters, science lab equipment, etc. Text2Teach, referenced above, can be considered a testimony to the value of multimedia in the classroom. Simpler solutions such as a tablet loaded with images and sounds can provide rich visual and audio support for vocabulary development where children are learning one and sometimes two non-native languages in school.

In addition to being an appropriate pedagogical model on its own, multimedia teaching is also a form of microlearning, if delivered in short, strategic bursts such as video microteaching or delivering supporting content to practicing teachers. Approaching microlearning from the perspective of mobile multimedia opens up possibilities of ‘virtual mentoring’ and rich multimedia distance learning as an alternative to traditional correspondence-based forms of open and distance learning that are still commonplace.

Mutual collaboration
Microlearning and multimedia are strategies that facilitate independent learning. Yet this does not mean that m-learning should be designed only for independent learning; it can and should also encourage collaborative learning by connecting learners to one another (Atwell, 2005; Brown, 2005; Pouzezvara and Kahn, 2007). For the purposes of this paper, any two-way interaction between learners facilitated by the mobile device is considered “mutual collaboration”.

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It is well established that social, collaborative and peer-supported learning techniques support development of higher order cognitive skills and problem solving more effectively than individualistic or direct techniques (Nouri, et al., 2011; Zurita & Nussbaum, 2004; Jefferies, 2003). However, there is not yet consensus on the ability of computer supported collaborative learning (CSCL) to do the same (Zurita & Nussbaum, 2004; Jefferies, 2003); the one-to-one, fixed nature of the personal computer interaction creates many limitations which mobile CSCL is trying to address (ibid.). m-CSCL leverages the ability of mobile devices to connect individuals to one another and to common content, all while allowing the learner to be on the move and interacting with the environment around him or her. An example of the power of global, mutual collaboration not just enabled by mobile devices but also dependent on them is the Project Noah, which brings crowdsourcing to education by drawing upon learners themselves to collect and share artifacts (in this case, examples of wildlife) using their mobile phones. As MOOCs—massive, open, online courses—gain attention and credibility, the possibility of moving these to mobile environments means that this mutual collaboration can even be massive collaboration.

Brown (2005) argues that communication and interaction play a critical role in the learning process from a constructivist perspective, and m-learning is an opportunity to foster an environment of rich communication and interaction. Along with Nyiri (2002), he argues that the strength of m-learning lies in a communication approach rather than a content approach (p. 304). Nouri et al (2011) also suggest that mobile technology creates opportunities for collaborative learning particularly for remote learners where there may be a shortage of teachers. Applications of m-learning in classroom situations highlight the ability of the approach to change classroom dynamics and create communities of learning that are more student-led rather than teacher-led.

The DEEP project in South Africa resulted in many examples demonstrating technology as a catalyst for changing classroom dynamics and learning methods through various forms of mutual collaboration, not just as a container for delivering content. Strigel and Pouezevara (2012) in their review of m-numeracy programs pointed out that a common added value cited in many of the m-learning programs, such as the Israel Math4mobiles program and the North Carolina K-Nect program is how the medium helps students feel part of the group, engage in peer or ‘communal’ support, and connect to teachers.

This form of increased motivation to participate, coupled with the microlearning theory of spaced delivery clearly provide a credible evidence base for improved learning outcomes through carefully designed m-learning programs. The Stanford Mobile Inquiry-based Learning Environment is an example of how multiple methods are used (microlearning with spaced repetition, mutual collaboration through a competitive, team-based question and answer format, monitoring of learning progress).

With access being a key driver of m-learning programs in developing country context (access to remote and disadvantaged populations, access to teachers in their classrooms, access to tutors or content that can substitute for teacher shortages, etc.) even the most basic models of communication without the added complexity of orchestrating collaborative learning activities (where learners share responsibility for a executing a task or solving a problem) can be valuable. The Bangladesh m-learning pilot mentioned above concluded that one of the key differences between the m-learning intervention group and the traditional training comparison group was that teachers in the m-learning program developed a community of learners within the school and even among schools (Pouezevara & Khan, 2007). Although multiple features were available on the phones (SMS, MMS, photographs), the most valuable and most used feature was voice communication with tutors and other teachers. Designing m-learning for developing contexts should not neglect the design of communication and activities that promote mutual collaboration, particularly for those who are in many other ways isolated or marginalized, but it also requires careful consideration of the collaborative structures, such as the role of the teacher, the distribution of tasks and devices, and how the technology mediates the learning process.

**Monitoring progress**

Besides accessing content or communicating with teachers and other learners, mobile learning can also be used to gather and monitor information about performance. It is often
said that “if you can’t measure it, you can’t improve it”. Teachers, for example, need to be aware of the quality of their own instruction and gaps in their children’s achievement in order to address those gaps and apply strategies that work. For Guskey (2002) seeing evidence of change is critical before teachers will adopt new teaching strategies.

There are many ways to carry out student assessment successfully without technology. The challenge is making use of the results. The use of measurement for results requires that the results be accessible and easy for the teachers and those who supervise them to use to inform their own instruction. Too often, results from national standardized tests remain at the national level, and teachers rarely get the feedback on performance, much less feedback that is more specific than classroom averages. Furthermore, it can sometimes be months, if not years, before the results of large national assessments are made available, at which time it is too late to change instructional practices—at least for that set of children (Strigel, 2011).

Data-driven approaches make it possible to “study learning in real-time and offer systematic feedback, both to students as well as teachers,” (West, 2012, p. 1). Doing so can help predict student outcomes and intervene before it is too late, both with remedial methods or with content more appropriately tailored to the learners needs. Where teachers are not available or lack the capacity for robust data mining, intelligent tutoring systems and can automatically provide performance analytics directly to students. As tools for research and reflection analytics can also help identify the inputs and strategies that led to certain learning outcomes. In particular, technology that assists teachers not just in evaluating progress, but also in making instructional decisions based on evaluation data can be effective in changing teaching behaviors, resulting in positive student outcomes. (Stecker et al., 2005)

The same technologies that allow us to introduce new forms of content delivery and learning can also change the way learners are assessed. In distance or mobile learning environments, assessment is likely also going to be mobile. However, traditional teaching and learning environments like those often encountered in low-resource classrooms can also benefit from mobile forms of mastery checking that allow instantaneous viewing of results, aggregating results over time, and presentation of results and progress over time in simple, easy-to-understand graphics. In large-scale programs such as MoMaths and mPREP Kenya, student self assessment and test preparation is also in high demand, possibly because of the gaming model that is used. Learning analytics provides the scaffolding that many learners need by linking to automatic feedback and practice tailored to their needs.

**Motivation**

The concept of “motivation” is hard to measure, yet most reports of m-Learning initiatives make reference at some point to the fact that users were ‘motivated’ by the format. For example, referring to the MoMaths program, GSMA (2010) reports: “The children thoroughly enjoy it - and have shown increased motivation towards maths studies” (GSMA, 2010, p. 17). Lan, et al. (2007) found that, like other studies before them, “mobile learning inspires enthusiasm in young adults and increases their motivation to improve their reading skills” (p. 142).

In many cases, motivation is measured and reported by self-reports of satisfaction with the learning experience. Motivation can partially be measured by demand and persistence; if learners are motivated they will seek out learning opportunities and spend more time engaging in them. They may also focus more attention on the task, and where possible, participate more fully in collaborative activities. Computer mediated communication is often considered motivating just because of the novelty effect; students enjoy working with new technologies and this may influence time on task; which in turn influences learning. Rau et al. (2008) also found that SMS communication between students and teachers, even when a traditional classroom is in place, created a bond that increased the motivation of the students without increasing pressure.

Much of the motivation reported in programs such as mPrep Kenya and M4Lit (also known as Yoza cell phone stories) is linked to the interactive, competitive and social elements afforded by the mobile phones. In the case of M4Lit, for example, readers do not just read, but they may also leave comments on chapters, vote in opinion polls about the story, and even submit stories of their own. Whether considered intrinsic or extrinsically driven, the
motivation that stems from friendly competition and public recognition is very powerful, and this is something that new technologies—including mobile ones—do very well. The mPrep program found that participation was affected more by using public praise and rankings (“uncertain incentives”) than it was by offering airtime as a reward. (mPrep, 2012).

Thus although motivation is an outcome of and even a driving factor for the use of m-learning approaches, the concept can also help us design better m-learning programs by remembering to carefully analyze what motivates learners and ensuring that this is reflected in the design of programs.

Why mobile learning strategies for developing contexts?

Prospects

The potential of m-learning to address key issues in improving education in developing countries now and beyond 2015 is convincing, particularly if planning and implementation takes into consideration evidence-based instructional design strategies such as microlearning, multimedia, motivation, monitoring and mutual collaboration. m-Learning can address issues of inclusivity by reaching previously excluded populations; m-learning can help address increased pressure on secondary schools by providing possibilities to extend learning outside the classroom, as in the case of MoMaths or ESIKO; it can improve cognitive and non-cognitive learning outcomes through innovative and disruptive methods that challenge learners in new ways, both individually and collaboratively; and finally it can be used to track progress and motivate learners to reach ever higher levels. Whether m-learning is truly able to impact education delivery financially is uncertain, but depending on the purpose and model of education or skills development, content delivered through SMS or 3G may be exponentially less expensive than traditional methods.

These promises are reminiscent of the potential of computers in schools to translate into improved learning outcomes, which many educational technology researchers and pundits claim are as yet unrealized (Newhouse, et al., 2002). However, a key difference between implementation of computers in schools and m-learning is that computer-based learning has often been too difficult for teachers to integrate into the school day because of their own limited capacity to use technology, or because of access challenges, e.g., too few computers, they are in a different room, scheduling conflicts, the electricity is down, viruses, etc. (Plomp, 2001). However, m-learning is circumventing some of these challenges, which are exacerbated in developing economies—electricity shortages, low-bandwidth or no Internet connections, teachers untrained in basic methods, and most likely having no prior experience with computers and no time to learn by doing. With mobile learning; children and adults alike have access to mobile technologies and are able to learn basic functioning quickly and easily because they are using the devices throughout the day. There is no need to “demystify” functions of mobile phones, such as SMS (Traxler, undated). Even more sophisticated forms of mobile learning such as touch-screen tablets can be learned easily by ICT novices of any age (Kim, 2008).

Limitations

Still, the potential of m-learning remains at the level of ambitious hopes and promises that are as yet unproven at large scale for specific populations. Many of the most successful models have been backed by major donors and companies after significant investments in time and resources. Such investments backed by influential partners with the capacity to push ideas into fruition are not always available for many other smaller yet equally as promising interventions. Rigorous research documenting the outcomes of m-learning is still scarce. Pollara and Broussard’s (2011) meta-review identified 219 articles focused on m-learning, but only 12 that met their inclusion criteria and of those, only 11 examined student learning outcomes. Furthermore, only 3 were experimental studies. This an other meta-reviews agree that the research is currently dominated by reports that are either descriptive and promotional, or if evaluative, limited to attitudes, feasibility and implementation considerations (Pollara & Broussard, 2011; Strigel & Pouzezvara, 2012).

More importantly, the intersection of m-learning and culture has yet to be fully explored. Although the proliferation of mobile devices and research conducted primarily in

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the developed world makes it easy to assume that m-learning is a natural fit for all current mobile users, we should challenge these assumptions when trying to transfer m-learning approaches to other less-researched contexts to understand whether some of the driving factors are still present. We do not yet know enough about the individual factors that affect adoption, execution and performance in mobile learning environments (Doolittle & Mariano, 2008). Certainly culture is one such individual characteristic that will influence m-learning outcomes as much as physical (dexterity, hearing, vision), cognitive (working memory capacity, problem solving skills), or affective (motivation, autonomy, ambition) characteristics.

Considering m-learning as a method for expanding access to or quality of learning can not be separated from talking about what ‘learning’ is in the particular context. How does the type of learning that is at stake and the learning culture (e.g., self-directed learning and habits of collaboration and negotiation in learning spaces) encourage or interfere with m-learning? For example, African worldviews emphasize belongingness, connectedness—the ubuntu philosophy of interdependency (Preece, 2013; Merriam, 2008). Merriam and Ntseane (2000) remind readers that learning for adult Malaysians is communal and religious or spiritual in nature, and in Senegal a community’s norms and values, such as viewing elders as key sources of knowledge, exerts a powerful influence when and how they choose to learn. On one hand, this may be more evidence for the importance of integrating mutual collaboration into m-learning programs, but on the other, will m-learning ever be a satisfactory alternative for traditional types of collective learning? Too little is known about whether immediacy and personalization of learning are as universal or ubiquitous as mobile phone ownership, particularly in the developed world. A major question remains: is m-learning supporting autonomy or is autonomy a prerequisite for making use of it effectively?

Conclusions

Where strong education systems are already in place, taking a pedagogical perspective to the process of m-learning design means paying close attention to the specific gap that the mobile technology is trying to address (Zurita & Nussbaum, 2005). Where education systems are barely functioning and the needs are so much greater, may be appropriate to depart from the access perspective and instead look at the characteristics of the devices that people already have, and then investigate how to leverage the characteristics to incorporate proven pedagogies—microlearning, multimedia learning, mutual collaboration, motivation and monitoring—to create new learning environments. In both cases, attention to the specific processes, settings, purposes and content of the learning environment and how they will interact with the local culture of teaching and learning is of utmost importance. While utilizing the “M’s” above can provide a guide to optimizing the features of mobile devices to create more powerful instructional situations that are both portable and mobile, we cannot immediately assume that these methods will be universally accepted. Like any other transnational educational transfer we must accept that certain elements will be adopted or transformed locally according to culture and values, and also seek out the local ideologies that will make for a better product in the end rather than contributing to their ongoing marginalization (Preece, 2013). Perhaps narrowing down ‘m-learning’ from a broad, multipurpose, technocentric method to access “the bottom of the pyramid” to the more specific instructional methods that are compatible with the mobile devices, we are one step closer to achieving that goal.

“The context for human development is always a culture, never an isolated technology. In the presence of computers, cultures might change and with them people's ways of learning and thinking. But if you want to understand (or influence) the change, you have to center your attention on the culture -- not on the computer.” (Papert, 1987).
References


