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Increasing Access through Mobile Learning

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CHAPTER 14

Mobile Learning in the Workplace: Unlocking the Value of Mobile Technology for Work-Based Education

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Abstract

The use of mobile phones is attracting considerable interest in the fields of professional learning and work-based education. Surprisingly, there is relatively little systematic knowledge about how mobile devices can be used effectively for learning and competence development in work contexts. Many of the current approaches tend to repackage eLearning content in order to make it suitable for the smaller screens of mobile devices — following behavioural and cognitive paradigms. By contrast, we attempt to illustrate in this chapter how mobile devices allow the realisation of rich pedagogical strategies. We use a number of educational parameters to characterise mobile learning (mLearning) as learning across different contexts that bridges and connects: 1) the creation and sharing of content; 2) learning *for* and learning *at* work; 3) individual and social forms of learning; 4) education across formal and informal settings, and (5) situated, socio-cognitive, cultural, multimodal and constructivist educational paradigms. We underpin our arguments with empirical studies from different fields and disciplines of work-based education. In so doing, we conclude that, in addition to sporadic, self-contained training, mobile devices can connect and span different situations and forms of learning and, accordingly, support learners across various contexts and phases of their career trajectories.

Introduction

Mobile learning (mLearning) appears to be an ever-growing educational phenomenon. In the field of work-based education and workplace learning, mobile technologies such as cellphones, smartphones and tablets are generating considerable interest. However, there is surprisingly little systematic knowledge available about how mobile devices can be used effectively for learning and competence development in the workplace — except for first empirical studies (see, for example, Pachler, Pimmer, & Seipold, 2011a, 2011b) and theoretical and conceptual discussions (Pimmer, Pachler, & Attwell, 2010). Before we elaborate our arguments, we will briefly problematise the notion of work-based mLearning, a rather immature and emerging field of practice and research. In so doing, we combine and draw on approaches from work-based learning and mLearning. Accordingly (and drawing on Pachler, Bachmair, & Cook, 2010; Pachler et al., 2011a), we understand "work-based mobile learning" as:

> "the processes of coming to know, and of being able to operate successfully in, and across, new and ever changing contexts, including learning for, at and through work, by means of mobile devices."

This rather broad scope refers to the dynamic nature of work-based education and includes education in informal learning contexts. Similarly, it bridges workplace learning perspectives and those that frame work-based learning as a series of formal educational programmes (Evans, Guile, & Harris, 2010).

Like every technological innovation, mobile devices have the potential to innovate and enrich existing educational practices. However, considering the use of technology to date, the opposite appears to be true. It has been argued that new technology has been primarily used to reinforce traditional, instructional and teacher-centred pedagogical approaches (Attwell, Cook, & Ravenscroft, 2009; Hug, 2009) — or in the words of media theorist Marshall McLuhan, "We look at the present through a rear-view mirror. We march backwards into the future" (Woodill, 2012, quoting McLuhan). In work-based education this seems to be true for technology-enhanced learning (Kraiger, 2008) and also for mLearning.

For example, results from one of the first studies in the field indicate that many experts expect the provision of content on mobiles for individual study to be the prevailing form of corporate mLearning in the near future (Pimmer & Gröhbiel, 2008). Indeed, many of today's mLearning "solutions" tend to offer traditional eLearning content on mobile devices, as exemplified by the following case study presented by Swanson (2008).

Traditional approaches to mobile learning: a case from the finance sector

A big company from the finance sector piloted mLearning for its highly mobile investment bankers. They provided compliance training material from the corporate learning management system (LMS) to the bankers' BlackBerry devices, mainly in a push mode. In order to make content suitable for mobiles, learning objects were downsized, for example by replacing multimedia-rich content with images and text. Learning was centred on individual, self-directed study. The compliance training intended primarily to prepare learners for potential future use. Industrial standards such as the Sharable Content Object Reference Model (SCORM) were used to guide and structure the technological and educational design in a rather formal way.

The pilot was considered a success: it was well received by managers and staff, who mostly studied "on the road," such as during business travel. Effectiveness was measured by a summative assessment. According to Swanson (2008), a 1.21% increase in average competency score for this group compared with the control groups was reported.

Table 14.1 summarises the main characteristics of what we consider to be a traditional approach to (mobile) learning in work contexts.

Table 14.1: Traditional approaches to technology-enhanced and mobile learning in work contexts

Contextual parameters	Traditional approaches	Excerpts from an mLearning case study (Swanson, 2008)
Content	Delivery	Standardised: "compliance training courses via BlackBerry" Reductionist: "Replace video and audio segments with photos or photo series and transcripts." Push: "courses were pushed out"
Proximity to work processes	Learning for work	Context-independent: "to deliver learning anytime and anywhere": 32% completed the learning during business travel, 24% while commuting to work, 26% at home, and 18% in the office or elsewhere
Social form	Individual	Human–computer interaction: "Allow the learner to … communicate back and forth with the internal LMS."
Degree of formality	Formal	Highly structured: "Standards, such as SCORM, helped guide the methodology for the technology design." …"tools for reporting, troubleshooting, course and learner-level permission structures"
Educational paradigm	Cognitive, behavioural	Outcome/summative assessment: "1.21 per cent increase in average competency score" Duration: "a more timely completion of compliance training, including a 12 per cent higher completion rate"

Learning Across Contexts

We do not want to criticise learning in the form described in the previous section. However, we do suggest that many opportunities would be missed if mLearning remained limited to the approach outlined above. We argue that the particular value of work-based mLearning lies in connecting learning across different contexts, thereby bridging typical dichotomies of educational science. Below, we describe a number of educational parameters — such as content, process, social form, degree of formality and educational paradigm — to show how different contextual dimensions can be linked by means of mobile devices.

Bridging Creation and Sharing of Content

Shrinking eLearning content to make it accessible on mobile devices might be the most intuitive approach to mLearning. Such efforts can certainly have their merits, in particular to reach distant and mobile employees, such as the investment bankers described above (Swanson, 2008), on-the-road engineers (Weekes, 2008) and professional drivers (de Witt, Ganguin, & Mengel, 2011; Stead & Good, 2011). We agree, however, with Woodill (2012), who argues that the "full potential of mobile communications for learning will not be realized until we stop producing learning apps or mobile websites that simple repackage classroom materials to be read or played with on a smaller screen." Instead, we suggest that, from a pedagogical perspective, the learner-centred creation and sharing of content such as multimedia materials in the form of text, audio, images and video is much more promising.

There are several examples in the literature showing how learners from different backgrounds adopt mobile technology to create and share their own learning content. For example, Brandt, Hillgren, and Björgvinsson (2005) demonstrate how nursing staff at an intensive care unit videotape the handling of technical equipment. The learning sequences produced were then accessed by colleagues through their hand-held computers. Similarly, Wallace (2011) shows how park rangers use mobile technology to produce digital stories of regular tasks and share them with their peers. These context-specific, multimodal and multilingual teaching materials are used as refreshers or as instructions for new members. Importantly, these two examples show that both production — in the sense of active knowledge construction — and sharing of the videos provided valuable opportunities for peer-to-peer learning and reflective practice.

Drawing on, and compiling, a multiplicity of different modes in the form of a story represents a multimodal design for learning. It also offers specific affordances for meaning-making and identity development (Bezemer, Jewitt, Diamantopoulou, Kress, & Mavers, 2012) — for example, allowing learners to demonstrate specific competences in their process of becoming full members in a community of practice (Brandt et al., 2005; Wallace, 2011). Generation and sharing of multimedia involves key functionalities of mobile devices. While multimedia capture is nothing new, the integration of various functionalities in one (mobile) device — referred to as convergence in the literature (Pachler, Bachmair, & Cook, 2010) — provides new and simple opportunities for learning.

Bridging Learning *for* with Learning *at* Work

Standard school systems as well as many forms of corporate training are based on the concept of "just-in-case" learning: declarative and often abstract and generic knowledge is acquired "off-the-job" to qualify learners for work. An example is the above-mentioned compliance training from investment banking that prepared learners for future application. By contrast, just-in-time learning normally takes place *at* work and is immediately relevant for learners (Harris, Willis, Simons, & Collins, 2001). Mobile devices can provide opportunities to connect both learning *for* and *at* work in that they support learners in situ when those learners apply abstract knowledge in order to tackle immediate work challenges. An example is accessing codified knowledge from Internet or intranet searches.

Findings from a recent study at IBM illustrate this view. Similar to the investment banking case outlined above, IBM initially considered delivering its 25,000 employee-development mini-courses "anytime and anywhere" on smartphones. However, they found that employees in nearly all businesses were not using their phones for studying online courseware. Instead, they accessed resources for "in-field performance support." These findings have led to a change in IBM's mLearning strategy: it started to prepare a system to better support employees in the solving of immediate work challenges by, for example, accessing checklists with critical information prior to client meetings from internal company networks (Ahmad & Orion, 2010). This is very much in line with the "pull principle" envisaged by Hagel, Brown, and Davison (2009). They stress the role of technology in helping people to access resources, not anytime or anywhere but exactly when needed.

While mobile phone based decision-making and problem-solving support can certainly increase productivity, its educational value needs to be examined more closely. Studies from the field of clinical workplace learning support the view that information provided directly at the point of care can augment self-directed learning practices. Examined, for example, is how medical students in clinical workplaces use mobile devices to support learning and sense-making that arises within the immediacy of a situation, linking codified knowledge from Internet sources with situated experiences (Pimmer, Linxen, Gröhbiel, Jha, & Burg, 2012). In another study, the impact of mobile clinical decision support systems was tied to learning and practice improvement (Grad, Pluye, Meng, Segal, & Tamblyn, 2005). Further studies from clinical workplaces demonstrate that the use of mobile phone or PDA-based decision support tools can decrease learners' uncertainty and increase their self-confidence (Axelson, Wårdh, Strender, & Nilsson, 2007; Leung et al., 2003).

Another form of mobile just-in-time learning are scenarios involving augmented reality. However, while developments such as Google's Goggles project appear to be promising, very little is known about how this technology can be harnessed for work-based education.

Bridging Individual and Social Learning

While the key functionality of mobiles is communication — that is, social interaction — it is surprising that so many mLearning solutions (such as the above case study from investment banking) are based on individual learning. This is all the more questionable in workplaces, since a great deal of competence development is rooted in "learning from other people" (Eraut, 2007).

In the IBM study described above, employees were accessing information sources on internal company networks in situ. However, when they lack information from these sources, they use their mobiles to involve subject matter experts, such as experienced colleagues who can help with immediate client query issues. Interestingly, the study also revealed that, compared with desktop PCs, employees were more likely to use their mobiles to communicate with "2nd- and 3rd-level individuals" — weak or loose connections outside their teams who were not originally intended to be the main points of contact. The IBM study also suggests that due to the ability of quickly locating colleagues, employees had an increased confidence level as well as an enhanced perception of their job performance.

Congruent findings (from the university context) report that the use of a social network site interacts with psychological well-being and helps in maintaining relations (in particular, weak ties) as people move throughout offline communities (Ellison, Steinfield, & Lampe, 2007). According to the network theory of "strength of weak ties" (Granovetter, 1973), weak connections can provide learners and organisations with particular work and learning opportunities as they facilitate the spreading of ideas and innovation beyond cliques or organisational units. This also seems to be in line with the importance that Hagel et al. (2009) attach to loosely coupled relationships "across large numbers of institutional entities so as to make them less transactional and more relational, ... and more supportive of richer cross-enterprise interactions and collaborations among their workers." Such an approach could also be realised by means of "people tagging," a particular form of social networking. Cook and Pachler (2012), using case studies, describe how employees gather information about persons inside and outside a company by tagging “each other according to the topics they associate with this person” (2012).

All these examples illustrate how mobiles can connect individual learning and problem-solving with social interaction.

Bridging Informal and Formal Learning Contexts

Mobile devices are much more widely used for learning in informal contexts than in formal training contexts. However, these devices can be used well to connect informal learning at work with formal learning contexts such as teaching in classrooms or mentoring. Lufthansa, for example, created a course concept where junior managers received short tasks and assignments in the form of text messages directly at the workplace (very informal learning settings). The tasks aimed at applying theoretical knowledge from previous face-to-face workshops (more formal educational contexts). In a second message, learners were asked how well they were able to fulfil the task (Lison, 2004). While this is, from a technological standpoint, a very simple concept, and while there is no evaluation available, we deem it an interesting example of how mobiles can be used to recontextualise formal knowledge in informal settings.

Conversely, mobile devices can also be used to link informal, on-the-job learning with more formal educational settings. There are several examples from vocational studies where apprentices use mobiles to bridge workplace learning with mentoring or teaching in the classroom. For example, apprentices from different fields such as forestry, construction work, travel services, youth and leisure guiding, and catering used their mobiles to answer a daily question about their learning progress such as: “I have felt myself needed today” or “I have learned new things today” (Pirttiaho, Holm, Paalanen, & Thorström, 2007). The questions were disseminated, collected and analysed by the teacher. Students could also enrich their online diaries by taking pictures, videos and sound with their phones and then debrief about experiences in classroom settings. Evaluation reports suggest that such approaches are well received by students and can enhance education by setting learning goals and by supporting reflective practice and self-assessment (Mettiäinen & Karjalainen, 2011; Pirttiaho et al., 2007). Similarly, Coulby, Davies, Laxton, and Boomer (2011) and Coulby, Hennessey, Davies, and Fuller (2009) report how students use mobiles for formative self- and peer assessments during placements. Results are integrated in e-portfolios and allow students and tutors to discuss assessment and wider placement issues.

Bridging (Socio-) Cognitive, Cultural and Constructivist Perspectives

With all new technological developments, researchers and practitioners (desperately) try to measure cognitive effects, mostly in terms of better knowledge recall/retention. In view of the rich learning strategies involved, we consider this a somewhat limited and unpromising endeavour. Accordingly, one might wonder whether in the investment banking case study a “1.21 per cent increase in average competency score” (Swanson, 2008) justifies spending much additional resources in adapting eLearning content for mobile devices.

Beyond cognitive views, we suggest that the value of mLearning in work settings can be perfectly explained by socio-cognitive, situated and socio-cultural perspectives. Other studies report how, from the perspective of socio-cognitive approaches, accessing resources in support of work processes can foster situated learning and meaning-making (Pimmer, Linxen, & Gröhbiel, 2012), enhance learners' self-confidence and reduce uncertainty (Axelson et al., 2007; Leung et al., 2003). Documenting learning progress for formal assessments or for learning diaries can facilitate reflective practice, namely reflection in action and on action (Schön, 1983) as well as increase the level of feedback (Coulby et al., 2009; Coulby et al., 2011).

In our own work we have shown how medical trainees use mobile phones to document "situated experiences" (for example, in the form of multimedia material that they then use for individual study and reflection prior to exams, as well as to "proudly show it to the others" (Pimmer, Linxen, Gröhbiel, Jha, & Burg, 2012). This example emphasises the importance of social dynamics and links being situated in socio-cognitive learning with socio-cultural practices.

A number of examples demonstrate socio-cultural perspectives on mLearning in workplaces. Chan (2011, 2011), for instance, reports that documenting and sharing authentic multimedia evidence of experiences of work and at work enhanced apprentices' self-recognition, self-acceptance and processes of identity construction. Occupational identity trajectories — that is, the way one becomes a central member of a community of practice — were, inter alia, evidenced through the willingness with which apprentices showcased their e-portfolios to peers, their employers and the wider social communities. Wallace (2011) also revealed how learners collected evidence of their professional competences by creating, sharing and reflecting multimedia learning materials. In that way, identities of empowered learners were connected. Wallace posits that mobiles supported "making meaning and connection beyond the educational to the social."

Similarly, we have shown in our own work how learners use mobile phones and social networks to participate in international professional Facebook sites that allow for the announcement and negotiation of *occupational status* and professional identities (Pimmer, Linxen, & Gröhbiel, 2012). Social network sites and mobile devices can also help learners bridge social capital and, as shown in the IBM study, access "weak ties" that, in turn, provide learners and organisations with particular work and learning opportunities as they facilitate the spreading of ideas and innovation across organisational units (Ahmad & Orion, 2010; Ellison, Steinfeld, & Lampe, 2007). From the perspective of constructivist learning theories, several studies report how the creation of learning materials can support active knowledge construction and peer-to-peer learning (Brandt et al., 2005; Wallace, 2011).

Conclusion

Traditional forms of training and eLearning in workplace settings are based on the individual study of educationally structured content in relatively formal learning settings in order to help learners "acquire" knowledge for (potential) future use. In addition to these approaches, we have shown how affordances of mobile devices allow the realisation of rich pedagogical strategies. They enable cross-contextual mLearning by bridging and connecting: (1) the creation and sharing of content such as multimedia material and digital stories in the form of audio, text, images and video; (2) learning *for* and learning *at* work (i.e., supporting competence development directly in the processes of work); (3) individual and social forms of learning (e.g., by means of social mobile networking, or the tagging and locating of experienced colleagues); and (4) education across formal and informal settings (e.g., by documenting on-the-job learning experiences by means of e-portfolios or reflective questions and discussing them in more formal classroom or mentoring settings).

By applying these strategies, the underlying educational design spans and connects situated, socio-cognitive, cultural, multimodal and constructivist perspectives of learning — moving the learner away from being a passive consumer to becoming an active producer and distributor as well as co-creator of multimodal designs and learning processes.

Traditional approaches to technology-enhanced learning tend to be sporadic and self-contained. In the initial case study for instance, time to completion and completion rates were measured (Swanson, 2008). The pedagogical strategies and empirical examples we have described in this chapter illustrate how the use of mobile devices and services can support learners across various phases of their identity and competence development, along career trajectories in and across new and changing contexts (see Table 14.2). This is an observation that is all the more important considering that competence development rarely occurs from one moment to another but evolves over time through connected learning experiences (Barnes, 2008). In this sense, mLearning in work-based education can bridge multifaceted learning contexts by involving various and rich educational approaches and paradigm.

Table 14.2: Contextual parameters to characterise work-based mobile learning

Contextual parameters	Traditional approaches	Enriched approaches: connecting contexts	Examples
Content	Delivery	Creation / sharing	• Producing and sharing of digital materials (audio, images, videos, text) of relevant work tasks
Proximity to work processes	Learning for work	Learning for work / learning at work	• Accessing of resources for immediate problem-solving in the processes of work on demand (pull)
Social form	Individual	Individual / social	• Social mobile networking, people tagging: creating loosely coupled expert networks and locating specialists for work challenges
Degree of formality	Formal	Setting: formal / informal	• Documenting of learning experiences/ formative assessment at work (e.g., mobile portfolios) and debriefing in classroom or mentoring settings
Educational paradigm	Cognitive, behavioural	Socio-cognitive, situated / social / cultural / constructivist and multimodal	• Situated learning, meaning-making, reflective practice • Bridging of social capital, spreading of innovation/ ideas, peer-to-peer learning, active knowledge construction • Identity formation, becoming a member of a professional community

In view of the limited scope of this chapter, we have been able to show only selective and (initial) empirical examples and to engage in rather limited conceptual and theoretical discussions. While we have not been able to provide any definite accounts of the emerging field, we hope that we have offered a jumping-off point as well as guidance for future projects in order to more comprehensively "unlock" and harness the value of mobile devices for work-based education.

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CHAPTER

15

Changing the Tunes from Bollywood's to Rural Livelihoods — Mobile Telephone Advisory Services to Small and Marginal Farmers in India: A Case Study

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Abstract

A number of efforts are under way in the developing world to apply information and communication technology, particularly mobile telephony, to advance national and local development. Outreach in farming is far less influenced by such efforts. India is a case in point. In this chapter we look at two strands of development: one is agricultural growth and the other is growth in mobile telephony. India has a very large base of mobile subscriptions and a disproportionately smaller number of them are found in rural areas. Revenue from mobile value-added services in India is driven mainly by the sale of ring-back tones based on Bollywood tunes. Food production in India is carried out primarily by small and marginal farmers whose access to natural resources, credit and new production technologies is limited. The economic value of their contribution has tended to decline over the last two decades. Extension as a public service, which lost its pre-eminent position of the 1960s, needs to be bolstered. Reach of mobile telephony provides an opportunity because the numbers of experts in institutional milieu are unfavourable for conventional one-on-one training or on-farm demonstrations. A few initiatives are taking place, but their number and scale is not adequate to build compelling models.

We describe a new initiative called vKVK (KVK is an abbreviation of a Hindi name for Farm Science Centre). This initiative uses a wide range of open-source software to develop Web-to-mobile and mobile-to-mobile voice and text messaging applications. These are used by agricultural experts in KVKs to form interest or commodity-specific groups of farmers who regularly receive group-specific messages from the local expert. Activities take place over widely varied agro-ecological zones covering dozens of crops and across the three language regions of India. The suite of techniques is described. Call statistics and call status data are presented. Finally, vKVK as a scalable public service is analysed in the context of ongoing for-profit efforts.

Introduction

Use of contemporary information and communication technology (ICT) in national and local development has its own challenges of technology, process, and enterprise or organisational management. A number of studies reported in the conferences of IEEE-ACM (ICTD, 2012) and in journals (ITID Journal, 2012) provide examples of applications and challenges. Use of mobile telephony in the application of ICT in development is thought to confer some advantages over those that favour a PC-with-Internet approach (Samarajeeva, 2010). A few examples of successful deployment of mobile technology oriented towards local development are frequently cited in the global media, such as the mPESA in Kenya in recent times (The Economist, 2012) or the Grameen Telephone earlier (Cohen, 2006). However, there are no established models available for deployment of mobile telephony in support of food and livelihoods security in rural areas of the developing world, especially when multiple agro-ecological zones, cropping systems, and languages are involved. Food production by resource-limited, smallholder farmers is an area where the attention of global development investors is focused. The work of the Gates Foundation is one example of this (Bill & Melinda Gates Foundation, 2011). Despite such interest, few mobile/ICT-for-development initiatives exist in this area of development. Available ones certainly do not operate on a scale sufficient to build models with.

In the next sections, we describe a novel, ongoing mobile telephony initiative in India that covers about 20,000 farmers regularly in four states of India, in three different languages. There is significant variation in the range of agro-ecological zones and crops covered. A key aspect of this initiative is the way voice and text messaging is maintained independent of the carrier that the user is connected to or the handset/device that he or she makes uses of.

Outreach and Extension in Farming in India: Key Role of Farm Science Centres

Food production in India is carried out mainly by farmers and their families. There are a total of about 90 million farm households across the country (DAC, 2012). According to the Planning Commission of India, about 70% of the farms are below one hectare in size, and half the farmers are illiterate. Just 5% of the farmers have reached post-secondary stage in education. Women are increasingly taking to farming and, in the typical rural Indian context, are vulnerable to limitations in access to credit and services (Planning Commission, 2007).

Public agricultural extension service is an important arrangement to help such massive numbers of farmers interface with domain experts based in institutions. It also provides an opportunity for farmer education and training. During the Green Revolution era in the 1960s (when India's wheat production doubled in just one decade), on-farm demonstrations conducted by researchers were considered to have been particularly effective in training and enabling risk-averse and resource-poor farmers to adopt new production technologies on a massive scale (Swaminathan, 1971). To consolidate and advance those process gains, the Indian Council of Agricultural Research (ICAR, 2010) set up local Farm Science Centres, or Krishi Vigyan Kendras in Hindi (officially abbreviated KVK).

A KVK provides an interface between farmers and technologies for crop, animal and fisheries production developed in national research centres and state agricultural universities. Onsite technology demonstrations and training programmes for farmers are important activities in a KVK, while providing advisory and alert services to farmers is an essential function. Typically, a KVK may be managed by, and would be a part of, an agricultural university or a national agricultural research centre or a non-profit organisation. The ICAR stipulates the norms for the functioning of KVKs and provides a reasonable proportion of the operating funds. There are 630 KVKs functioning in India now.

Growth in agricultural production and agricultural GDP of India maintained a rate above the population growth well into the 1980s. There has been some volatility and decline in agricultural growth rates since then (Planning Commission, 2007). This has led to serious concerns about the continuing decline in the real income of farmers — about 48% of the farming households are in debt — and its potential impact on national food security.

The Indian National Commission on Farmers (NCF), in a series of reports during 2004–2006, recommended an elaborate set of measures to revitalise agricultural growth in India (with a focus on improving the well-being of farmers) and to mobilise greater public investments. One of its key set of recommendations relates to strengthening the extension system through bringing domain experts and farmers together in a more active mode of information and knowledge exchange using ICT (NCF, 2006). An independent study around this time, carried out by India's National Sample Survey Office (NSSO), covering 100,000 farm households, revealed that close to half of all farmers surveyed were accessing information on food production technologies and markets from relatives/friends and from local input dealers (NSSO, 2003). This study revealed that the KVKs were not being accessed by farmers as well as originally envisaged. In two different studies at a more micro-level (clusters of villages), a similar trend had been noted (Balaji, 2006).

Anticipating the potential inadequacies in the mostly person-to-person training and technology demonstration approaches, researchers thought that PC-based ICT services would have the power to usher in a new paradigm of computer-aided extension (CAEx, in the style of CAD/CAM) (Swaminathan, 1993). However, this had not been realised until as late as 2008. Although India had, by then, close to 10,000 active rural/village information centres equipped with PCs, few of those had an impact on agricultural extension processes that involve KVKs and farmers (Balaji, 2009).

Around this time, the ICAR launched a series of initiatives under its National Agricultural Innovation Project (NAIP, 2013), aimed at enhancing the capacity of national agricultural research centres and state agricultural universities to deploy contemporary ICT and Knowledge Management practices and improve research-education-extension linkages. The current initiative vKVK (vKVK, 2013), or Voice KVK in original expanded form, is part of the series of projects supported by the ICAR through its NAIP channel. Its thrust is on deploying mobile telephony services in support of KVKs' advisory services function, enabling experts and farmers to work in group-casing, interactive mode. This is anchored in the framework of Agropedia (Agropedia, 2013), which is a broad-based programme to build an ecosystem of semantically enabled applications in support of farming in India.

We shall briefly look at ongoing efforts and concerns in India's mobile telephony for the development sector while emphasising the unique character of vKVK: it is the only such project that links farmers and experts in agricultural universities and national research centres. Neither group of stakeholders needs to depend upon particular telecom service providers or handset manufacturers.

Mobile Value-Added Services and Mobiles-for-Development in India

India has a substantial base of mobile telecom subscriptions — about 950 million in the third quarter of 2012, according to the Telecom Regulatory Authority of India (TRAI, 2013). Besides this very large number, the speed of spread of mobile telephony in India is an important factor to note, with tele-density (number of telephone lines per 100 population) moving from under 4.38 in 2001 (Minges & Simkhada, 2002) to 67.67 in 2011 (ITU, 2011). The urban tele-density is thought be over 100. The spread in rural areas is lower than in urban areas, and the TRAI estimates that the number of rural subscriptions as of June 2012 is between 150 million and 160 million. The rural population accounts for 68% of the total population, according to the Census of India (Census of India, 2011). A typical handset with a rural user is likely to be a basic instrument with voice and texting capabilities. Most such handsets cannot display characters in Indian languages, thus making voice the principal medium of use.

Telecom industry analysts have pointed to this disparity as an important opportunity for expansion of the industry. Analysts have also observed that the mobile telecom revenue derived in India is mainly based on voice usage. Data services do not offer a proportionately large stream of revenue because most businesses do not offer mobile data applications and services. The principal non-voice service for the industry is the sale of caller ring-back tones (RBTs) which enable a user to personalise his or her mobile presence in an affordable way (Ravishankar, 2012).

A very large proportion of RBTs are derived from Bollywood film music, hence the view that Bollywood has a role in the rapid spread of mobile telecom in India. A recent analysis of mobile value-added services in India shows that human development services, such as health alerts, do not find adequate numbers of customers, and telecom service providers are thus not keen on expanding into these markets. The need for such services in India, however, which is a country of ultra-poor people, is enormous. Here, then, is a case where market presence and profit orientation are not leading to the expansion of reach and servicing to those who need it most.

To their credit, telecom service providers and handset manufacturers have been offering a small range of development-oriented services tied to their particular brands of services or handsets. A significant example is the IFFCO Kisan Sanchar Limited (IKSL, 2013), which offers farmer messaging services to those who subscribe to Airtel (Airtel India, 2013), the largest telecom service company in India in 2012. The messages are generated by IFFCO (IFFCO, 2013), a public sector fertilizer company. Another example, Nokia Life, provides information services to rural users who purchase a particular range of Nokia handsets (Nokia, 2013). Device and telco-independent services — such as Reuters Market Light (RML, 2012), mKrishi (TCS, 2013), a suite of delivery-oriented applications for companies such as those selling inputs, and Ekgaon (Ekgaon, 2013) — have also been launched in the last few years. This is a mix of large and small players, and we can infer that there is indeed space available for more rural-oriented value-added services for a variety of players, large or small.

The vKVK Initiative: Process and Technology

The vKVK, as noted earlier, is an effort to bring subject matter experts in agricultural extension centres together with farmers, using mobile telephony as the medium. Its uniqueness is in the fact that it is anchored in the institutional milieu of agriculture and is driven by domain experts, not by telecom service providers, handset manufacturers or software developers. The farmer is in focus. At the core of vKVK is the subject matter specialist in a KVK who has an intimate knowledge of local farming conditions in the area of coverage. It is often the case that the subject matter specialist knows many farmers and their practices personally and is engaged in facilitating formation of groups of farmers around specific interests or crops and commodities. One of the key features of the vKVK initiative is to enhance the expert's ability to facilitate the formation of farmers' groups. Experts at the KVKs are of the view that farmers respond better to group-specific messages than to globally broadcast messages. Another key feature is the capability of vKVK to provide a farmer with the facility to contact the expert based in the locality in order to resolve a query. This is important because farmers tend to value advice more if it is from a known and trusted human source, such as experts whom they know locally.

The vKVK initiative has been in regular operation since August 2011 and covers 97 KVKs in various states of India: Uttar Pradesh (Hindi), Uttarakhand (Hindi), Karnataka (Kannada), in the Telengana region of Andhra Pradesh (Telugu), and Gujarat and Kerala. Figure 15.1 shows the locations of these states.

The suite of techniques deployed in vKVK was developed entirely at the Indian Institute of Technology Kanpur (IITK). These include:

- a Web interface for the expert to create new groups of farmers by commodity/crop, locality or specific interest; or to add or change memberships in groups;
- a Web interface for an expert to record and/or upload an audio message (maximum of 60 seconds) and add subject-specific tags to it; and to set up schedules of delivery (including repeat calls if the called party is unavailable);
- a Web interface for an expert to create a text message in any of the three languages (Hindi, Kannada or Telugu); and to set up delivery options;
- a calling number for the expert to dial up and record a voice message for delivery to a group at a particular time or for immediate delivery (a single number is used across all the areas covered). This mobile-to-mobile arrangement, as it is known among the KVK-based experts, is proving to be popular, especially in the Hindi-speaking regions.
- a single number for any registered farmer to call an expert or to leave a voice message; based on the caller's location, the call is diverted to the expert in the "home" area of the farmer;

- all text and voice messages, together with tags, aggregated in a semantically enabled content aggregation platform, the Agropedia (Agropedia, 2013), which enables any expert to view and listen to messages (audio/text) he or she previously uploaded.

Figure 15.1: States of India where the vKVK project operates (lighter colour).

The schematic for the services architecture is shown in Figure 15.2 along with those for the Web-to-mobile and mobile-to-mobile services (Figures 15.3 and 15.4). The terms E2F (expert-to-farmer), F2E (farmer-to-expert) and E2E (expert-to-expert) are used in Figure 15.2. Screenshots of the expert's Web console for creating and tagging messages are shown in Figures 15.5 and 15.6. All these services are hosted in, and operated by, IITK, which serves as the lead for the vKVK initiative.

Figure 15.2: vKVK services architecture.

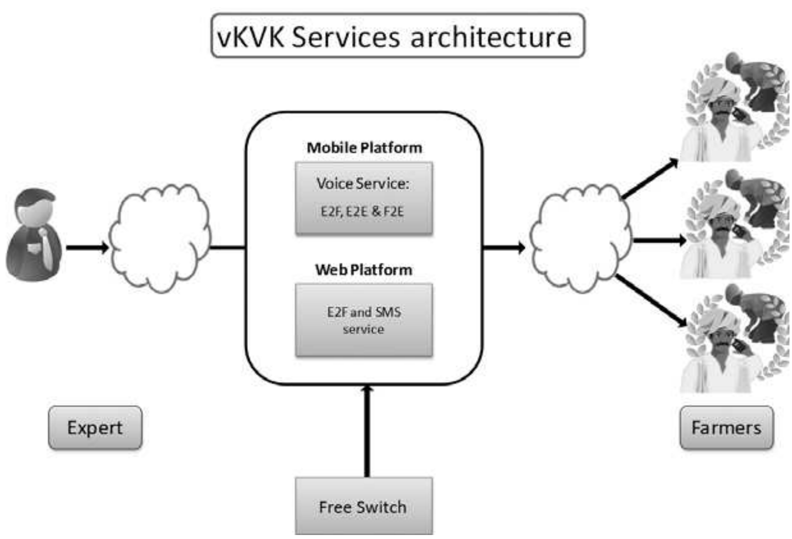

Figure 15.3: vKVK Web-to-mobile service architecture.

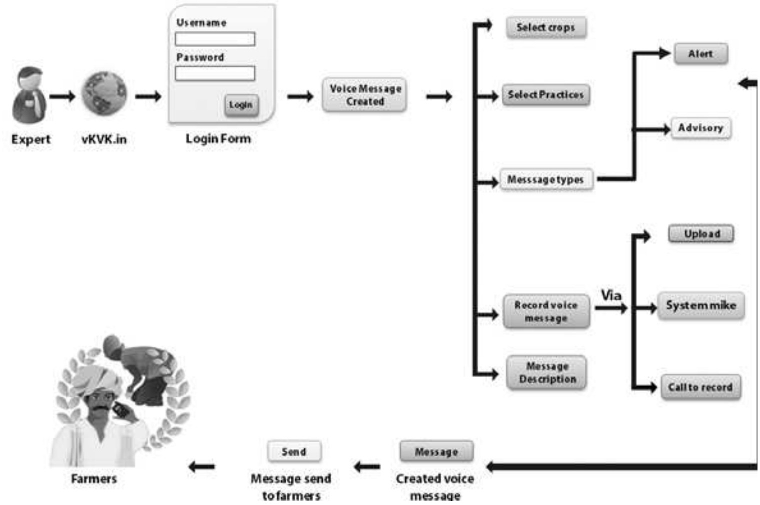

Figure 15.4: vKVK mobile-to-Web service architecture.

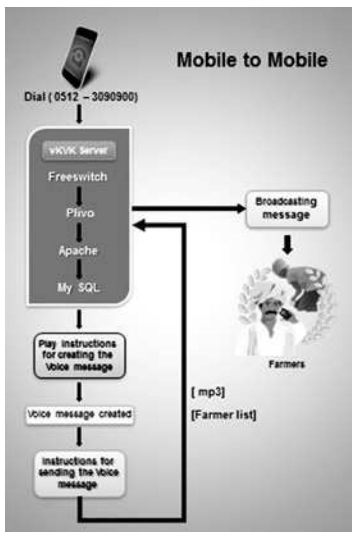

Figure 15.5: Web interface for the expert to create a text message for the farmer.

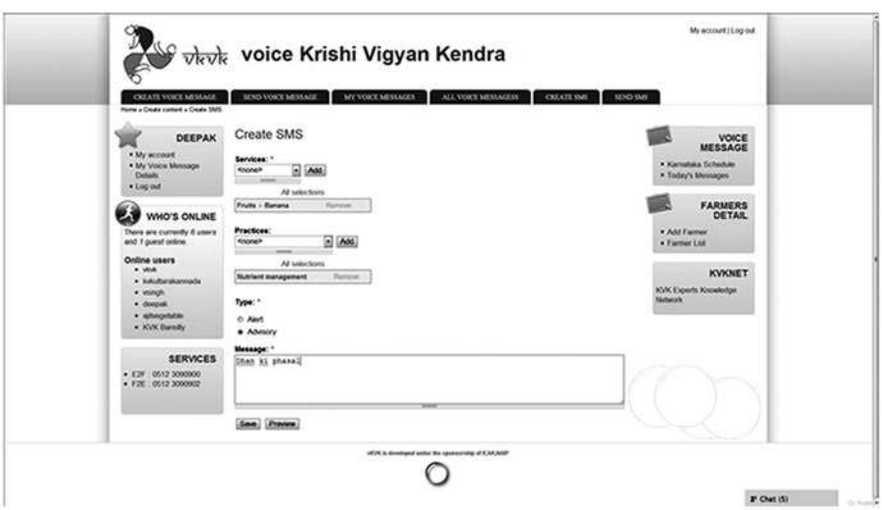

Figure 15.6: Web interface for the expert create or upload a voice message.

Launch of vKVK as a regular service in August 2011 was preceded by limited yet intensive trials for four months in 2010. The services were fine-tuned. A series of capacity-strengthening sessions was organised so that KVK-based subject matter specialists became conversant with the processes of registering farmers in groups and in recording messages to issue alerts or advisories. Although the original intent was to cover only 20 KVKs in the states of Uttar Pradesh and Uttarakhand, all of the 80 KVKs in these two states joined the initiative by late 2011. One subject matter specialist represents one KVK. There are 98 experts active as of November 2012, covering 97 KVKs (out of 630). The agro-ecological zones covered in these states range from alpine and sub-tropical regions in the Himalayas to dry, semi-arid tropical regions in South Central India.

As of November 2012, the number of farmers regularly using this service was 19,967. The range of crops and commodities covered over three cropping seasons is large: cereals – 9 (including wheat, barley, rice, maize, sorghum and pearl millet); pulses – 7; oil seeds – 8 (including groundnut/peanut and sunflower); vegetables – 16 (including beans, eggplant, cabbage and carrot); flowers – 7; fruits – 52; spices – 13 (including pepper and cinnamon); and plantation crops – 8 (including coffee, tea, cocoa and cashew). Livestock advisory services are focused on dairy cattle, pigs, small ruminants and poultry.

Data on calls made and texts sent is presented in Table 15.1. There is a regional variation in the number of calls and texts delivered to the farmers. The pick-up of services has been rapid in the State of Karnataka in South Central India, followed by Uttarakhand in the Himalayas. This is partly due to the fact that Karnataka is better served with telecom services, and the institutions there are faster in absorbing the combination of Web interface and mobile telephony in farmer communication. Data on status of voice calls is presented in Table 15.2. On average, about half the calls made from the KVKs to farmers are picked up. Regional variations are not unknown and analysis is in progress. Technology failure rate has been very low as measured in the number of Free Switch server crashes.

Table 15.1: vKVK operations (August 2012 – October 2013)

State	Number of farmers	Voice messages	Text messages
Karnataka	14,430	928,852	45,719
Uttar Pradesh	8,877	291,232	44,616
Uttarakhand	1,451	15,889	5,144
Andhra Pradesh	970	26,633	3,285
Rajasthan	1,492	23,754	--
Gujarat	757	11,019	--
Bihar	2,766	57,680	--
Kerala	1,140	13,336	--
Total	883	1,368,395	98,764

Table 15.2 : Status of call statistics: two consecutive months (2012)

Status of calls	Number of calls	% of total
Answered	75,968	48.76
Not answered	42,426	27.23
Failed	29,661	19.04
Busy	7,736	04.97
Total	155,791	100.00

Discussion and Conclusion

The vKVK project is in an early stage and methodologically rigorous impact studies will begin at the end of the cultivation season in early 2013. The impact analysis would include quantified data on satisfaction among farmers who used this service. Also of interest will be the number of small and marginal farmers, and women participants, since their participation in knowledge-sharing is considered a priority in policy planning. A key as well as immediate indicator of successful uptake is the number of domain experts who have signed up. It was expected that the number of KVK experts to sign up would be 28; the current number is much higher: 98. This compares favourably with IKSL, an older project of much larger financing, which has 53 experts registered. All the experts on vKVK offer services wholly for free and do not charge either the farmers or the project.

Agricultural knowledge in the Indian context has a prescriptive character. Although there is no explicit or formal regulation as to who can provide an alert or advisory, the norm is that the source of information is anchored in validated expertise. Even though there is no formal system to accredit or register agricultural practitioners as in medicine, institutional considerations and values are involved in identifying valid sources of knowledge. This is why securing the involvement of institutionalised expertise is critical in promoting viable knowledge-sharing practices in support of farming in India. The vKVK initiative has been successful in addressing this requirement from the launch stage and has gathered a wider following than originally envisaged.

Costs are also a consideration. As examples, the IKSL and the RML projects present two different business models: IKSL uses the clientele of a super-large telecom services provider through a commercial partnership; RML aims at revenue generation from user subscriptions. The university and research institution expertise is not directly linked to either of them as it is with the vKVK. The federal Planning Commission of India has stated that "extension should be treated as a service delivery mechanism and not be viewed as a revenue-generating program. Hence, the principles governing business models of a revenue-generating program should not be made applicable for extension services" (Planning Commission, 2007). In that spirit, vKVK has been funded by the ICAR to build and test an essential support service that contributes to increased awareness among farmers. However, as observed by an analyst of the telecom industry in India, the fund of the Universal Service Obligation (Government of India, 2002), collected by the federal government in India from telecom service providers, is close to USD 4 billion, with little being spent (Uppal, 2012). Farmer-oriented initiatives such as vKVK could perhaps draw upon that source as well, through an innovative public-private partnership in the spirit of public service.

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CHAPTER 16

The Future of Mobile Learning and Implications for Education and Training

David Parsons

Abstract

The future of mobile learning (mLearning) in education and training holds much promise, but it also poses many challenges and dangers. In imagining what mLearning may mean to us in the years to come, we should be wary of making predictions. Nevertheless, we can reflect on current and emerging technology and practice and usefully suggest how we might guide their future application and development. In doing so we should be careful not to ignore the lessons of the past, continuing to engage with the deeper questions about teaching and learning that will continue to underlie the application of learning technologies. This chapter is structured primarily as a series of "top fives" under different headings, intended to highlight some of the concerns of mLearning, both now and in the future. These cover mLearning myths and misunderstandings, mLearning innovations, and both the potentials and risks for mLearning in the future. Together these various perspectives on mLearning seek to provide an inclusive view of what mLearning means today, recognition of the best achievements of mLearning so far, and an agenda for the future that will, we hope, assist us in gaining the maximum benefits from mLearning while minimising the potential negative effects of technological, social and pedagogical change.

The Future Is Now

A few months ago, a student research assistant brought one of his home projects to show to a class, a robotic vehicle controlled by the orientation of a mobile phone. His current project is using off-the-shelf hardware to control the robot with brain waves. In a world where amateur student projects involve the mind control of robots, it is hard to look ahead without finding that one's predictions are already part of everyday life.

With this caveat in mind, this chapter begins with a brief mobile learning (mLearning) scenario from a possible future.

> Mobile learning as we approach the middle of the 21st century is just part of life. The old model of educational institutions has withered away, with learning now a lifelong, pervasive experience, delivered via the practically invisible devices that I have with me day and night, the personal network that delivers information to my eyes, ears and other senses, the e-glasses, the flexible smart-touch screen that folds into a small case but expands to poster size and will stick to or project onto any surface. These devices seamlessly connect and collaborate with ambient technologies in the environment. For example, in my informal learning activities related to photography, my camera will scan for nearby 3D printers to create models from my 3D photos. For my interest in literature, scenes from books play out in front of me if I happen to enter a location used by one of my favoured authors. For somewhat more formal learning, I attend immersive virtual reality classes whenever I want, mixing my avatar with those of other virtual students and both real and robot instructors. I learn when I need to, where I want to. When I am at work, I have professional learning support with me at all times, guiding me in new situations, online Artificial Intelligence systems reacting to my ever-changing contexts and giving me expert task and problem-solving support. I have all the knowledge ever gathered available in an instant, tailored to my own learning profiles and preferences, quality controlled by the world's best minds. Not that I am just bombarded with data. The mobile learning systems that I use are able to help me filter the huge amount of data in the computer cloud, assisting me in making meaning out of a mass of information, working with my own goals, learning styles and changing moods and activities to ensure that the material I am exposed to will help me learn rather than overwhelm me. As a mid-21st-century learner, I am never lost, never alone, never unsupported, never not learning.

If there is one thing that can be said for trying to predict the future, it is that we are bound to be wrong, at least if we try to go beyond very broad assumptions such as "the use of mLearning in education and training will increase." We might therefore consider what the merits might be of attempting to look ahead to the future of mLearning, and the possible implications for education and training. Perhaps in doing so we might reflect on the idea that writing that purports to look to the future is often instead recasting the present through another lens. A classic example of this would be George Orwell's *1984*, the title of which a number of commentators, including Burgess (1978), have suggested is a partial inversion of the year the book was written (1948). Much science fiction follows similar themes, projecting current concerns either near or far into the future. Those who look at "near future" fiction and dismiss its inaccurate predictions (think *The Shape of Things to Come, 2001, A Space Odyssey, Blade Runner* or even *Back to the Future*) miss the point that accurate prediction is not the purpose of such creative works. Rather, they hold a mirror up to the present that reflects the potential implications of our present actions.

Thus, this chapter does not propose to attempt accurate predictions of the future. Instead, it intends to reflect on the current technologies and affordances of mLearning, and consider which of these might continue to be useful to us in the future, as the worlds of work, learning, technology and society continue to evolve. In fact, the somewhat futuristic scenario above is based on the work of Golding (2008), who begins his book with a similar type of proposition based, as he makes clear, not on fantasy technology but by extrapolating from what we already have, here and now.

Top 5 Mobile Learning Myths and Misunderstandings

In an attempt to look ahead to the future of mLearning, one thing that may unnecessarily hold us back is making assumptions about what mLearning is, or what it could be, and so we could fail to appreciate its full set of potentials. This section lays out a "top five" of mLearning myths and misunderstandings. In doing so, it should be noted that these are not necessarily wrong; rather, they provide excessively limiting definitions of mLearning that do not serve us well in truly knowing what it means to be a mobile learner. In fact, in the examples that follow, we might easily insert the word "only" to make the point that these are all valid views of mLearning, but all are too restrictive to truly reflect what mLearning can be. In this section, we will take apart each of these myths and misunderstandings and explore how these definitions can limit our ideas about what can be achieved in mLearning.

Mobile Learning Is "Anytime, Anyplace" Learning

This is perhaps the most prevalent view of mLearning. The image is frequently used of commuters "learning" from a mobile device on the bus, on the train, etc. The limitation of this definition is that it focuses on the pervasiveness of the learning, but perhaps neglects the concept of mLearning at *this* time, in *this* place — in other words contextualised or situated learning (Seely Brown, Collins, & Duguid, 1989). One of the major affordances of a mobile device is that it can be brought to use in a specific context, a concept not acknowledged by "anywhere, anyplace." To only follow this thread is to risk disconnected learning fragments, isolated from the reality around us.

Mobile Learning Is "Just In Time" Learning

There is nothing wrong with the concept of just-in-time learning. In fact, it is often used as the main justification for using mLearning in the workplace; the ability to get the information when and where you need it, at the point of delivery. The problem with just-in-time learning is that it potentially bypasses any concept of a curriculum, or a developmental frame within which learning takes place. It raises rather deeper questions about what we mean by learning. Is looking something up on the fly learning? Does it matter if you remember it or not (given that you can always look it up again)? This type of learning is sometimes called "performance support," and perhaps this is how we should define it: not as learning, but as a tool to be used in the performance of various duties and responsibilities. Learning, we must assume, should go deeper than this.

Mobile Learning Is Learning While Mobile

This is an interesting misunderstanding, as it challenges us to consider what we mean by "mobile." Is there an inherent expectation that the key to what we are doing is mobility? And what does mobility mean: Actually being in motion? Or being able to transition from place to place? We rarely learn while physically moving (leaving aside being in a moving vehicle) since the distractions are usually too problematic (Doolittle, 2009). What we tend to do is take our learning tools with us to the appropriate places. This raises the question: Do these learning tools need to be mobile devices? Or can we do mLearning with books, pens, paper, etc.? Indeed, in some experiments comparing mLearning solutions to paper-based solutions, it has been difficult to see the benefits of using the mobile device over the paper-based version (Fisher et al., 2012). Of course this will depend very much on the affordances that we require to deliver a particular type of learning. In some cases, traditional learning tools, in a learning context, will be able to deliver as much learning as any technology-based solution. In other cases, new technologies are essential to the activities.

Perhaps if there is confusion of perceptions here, it may be that some approaches to mLearning are seen as device centric whereas others are seen as learner centric. Both approaches, of course, have merit, but a learner-centric approach might tend to consider types of learning where the mobile device plays a minor role, whereas device-centric approaches are often those that push the boundaries of current tools exploring the new potentials of emerging and disruptive technologies (e.g., Ogata & Yano, 2010). It is interesting to consider Amit Garg's "Top 7 Myths of Mobile Learning" (2012), and note how many of these myths are about technology rather than learning, including perceived issues with screen size, costs of creating and distributing content, security, fragmented platforms and SCORM compliance. Garg's point is, perhaps, that we can easily get hung up on technological aspects of mLearning when these are not important barriers at all.

Mobile Learning Is an Extension of eLearning

There is a common approach to mLearning that is based on the mobilisation of existing eLearning systems, particularly learning management systems (LMS). An example of this would be mobile clients for the Moodle LMS. Many commercial eLearning providers have embraced the rush to HTML 5, keen to stress how the same content can be developed for desktop computers, tablets and smartphones. The problem with this approach is that the best that can be hoped for is content designed for eLearning adapted for a different form factor. It does not take into account any of the additional affordances of the mobile device, such as location awareness and both synchronous and asynchronous collaborative communication. "In reality, mlearning is different from elearning in terms of size of courses that can (or should) be delivered on mobiles; the context in which mlearning is accessed. Designers must consider the always on nature of phones which help capture the moment of creative learning and other such factors" (Garg, 2012).

Mobile Learning Is an Extension of Distance Learning

It is true that distance learners can benefit from mLearning. However, once again to regard the mobile device as only for use at a distance is to miss its opportunities for use in the classroom, where mobile applications can support learning processes. Indeed one of the major current movements in education worldwide is the integration of mobile devices, particularly tablets, into the daily life of the classroom. Some applications of mobile devices in the classroom have in fact seen them become embedded in the environment itself, thus becoming entirely static (e.g., Moher, 2006). Nevertheless, they still provide one form of mLearning, with mobile students using mobile devices that just happen to remain in one place.

To draw some ideas from these myths and misunderstandings about the future of mLearning in education and training, perhaps the main concern is that future mLearning tools may continue to use narrow definitions of what mLearning is (for example, just the mobilisation of an existing eLearning system) driven by the target markets of a particular vendor, or an emphasis on worker support tools by employers. To ensure that future mLearning systems meet their full potential, it is necessary that our understanding of mLearning encompasses all of its unique characteristics, and that we recognise that any form of learning that takes place using a mobile device is mLearning, whether on the move or static, whether in formal or informal settings, whether working collaboratively or alone.

Top 5 Mobile Learning Innovations

If the previous section took a somewhat negative viewpoint about myths and misunderstandings that might hold back the development of future mLearning, this section provides a more positive perspective of how mLearning is unique and powerful. In looking at the “top five” innovations describing the ground-breaking features of mLearning, we can see why definitions saying that mLearning is just an extension of eLearning or distance learning do not do it justice. It is important to note that these are not just technical innovations, but examples of how technology and pedagogy have been used together. Most (though not all) of the ways of learning listed below have an intimate relationship with the concept of mobility, emphasising the unique role that a mobile device can play in learning. In all cases, there are significant differences between these activities and traditional eLearning. Even where these are also standard learning activities (e.g., contributing to shared-learning resources), doing these things with mobile devices provides a much broader range of opportunities for gathering and exchanging knowledge with other learners and teachers.

Placing Learning in a Specific Context

One of the main affordances of a mobile device is that you can take it with you wherever you go. Much has been written about the importance of context in learning, to support situated cognition (Seely Brown et al., 1989). This idea has been much explored in mLearning projects, where the museum, the woodland or the city become meaningful locations for learning to take place. The great thing about having a modern mobile device is that it is a compendium of tools — an electronic Swiss Army knife. As such, once you are in a given context, it can help you to measure and analyse, to capture and publish, to organise and communicate. This means, for example, that learners can apply mathematical or scientific inquiry in real-world problem-solving situations, using mLearning tools such as MobiMaths (Tangney et al., 2010).

Augmenting Reality with Virtual Information

With a mobile device, you can overlay something virtual onto something real. This has proved a very popular theme in recent mobile applications. Augmented reality tools such as Google Goggles, Wikitude and Layar show the potential for using a mobile device to give you information about artifacts, locations, etc. in areas as diverse as architecture, history and geography. Beyond these common tools, which overlay factual information onto what is physically present, there have been a number of mLearning applications where a virtual reality has been superimposed onto a physical location in order to provide a new learning experience. These include Savannah (Facer et al., 2004) and Invisible Buildings (Winter & Pemberton, 2011).

Contributing to Shared Learning Resources

One of the key themes of Web 2.0 is the concept that Web-based resources no longer work in one direction only (from a server to a client), but that users become their own content creators. A valuable aspect of learning is the ability to create new material and share it with others, for peer review and collaborative learning. Being able to do this with the assistance of a mobile device, which you can have with you in many contexts, broadens the range of sharing opportunities. It also further enhances the concept of bricolage and diverse learning ecologies (Seely Brown, 2000), in this way making meaning out of the digital artifacts we create from the physical and conceptual learning moments that we constantly encounter. The ability to learn while communicating and contributing at a distance with other learners supports the concept of distributed cognition (Hutchins, 1995). While the initial work in this area found this distribution to be among groups physically co-located, the concept also includes communication with others at a distance. An early example of this type of mLearning can be seen in the distributed collaborative field work described in the Wireless Coyote project (Grant, 1993).

Having an Adaptive Learning Toolkit in the Palm of Your Hand

A mobile device is increasingly a toolkit. As well as the tool-like functions that are built in to the device hardware (camera, sound recorder, video recorder, multimedia messaging, etc.), there are also many applications that can take advantage of various combinations of functions and sensors to make the phone into all kinds of tool. Your mobile can be a distance-measuring device, a guitar tuner, a musical instrument, a compass, a speedometer, a spirit level, and a whole range of other things. This allows the device to be adapted for use as a supporting tool in an almost infinite range of learning activities. In particular, the role of device as tool is well suited to supporting inquiry-based learning (Powell et al., 2011). Whether being used as a support tool to scaffold learning in the classroom or as a means to capture learning experiences in the field, there will be some kind of hardware and/or software feature that can be utilised in the learning process.

Taking Ownership of Learning

One of mLearning's most significant innovations has to do with the ownership of personal learning devices. The personal digital device gives learners the ability to appropriate and personalise their own learning experience, to autonomously acquire the learning material that they want, whenever and wherever they wish to do so. Equally, they have to ability to capture their own learning moments (take photos, videos, notes) and share their insights or questions with others using social media and LMS. Emphasising the personalisation of learning, Sergio (2012) notes that "'m' usually stands for 'mobile' but also just as easily for 'me.'" He further acknowledges the importance of accessibility, noting that mLearning opens access to all kinds of people who previously had limited access to learning, in particular in areas of the globe where some members of society have had no previous access to any technologies that could support learning.

To reflect on the innovations covered in this section, we can see that mLearning encompasses learning that is situated, collaborative and adaptive. In addition, it provides for augmented and virtual realities that provide learning opportunities that go beyond physical environments. Increasing accessibility also means that mLearning can be for the many, not just the few. In the future, we can look forward to these themes developing more broadly and becoming more pervasive. Future mobile learners will have devices that can act as all kinds of learning tools, simulating and supporting all kinds of learning environments, and providing access to mLearning for all, regardless of their location, culture or socio-economic status.

Top 5 Future Potentials for Mobile Learning

Perhaps the most important aspect of a chapter looking at the future of mLearning is to look forward to its main potentials. These are based primarily around the increasing power and pervasiveness of mobile devices, and their mass integration into the world of teaching and learning.

All Students in a Class Can Use Their Own Device for Learning

Perhaps the defining characteristic of mLearning in the second decade of the 21st century is that the Bring Your Own Device (BYOD) approach has suddenly become the norm rather than the exception. This opens up major new opportunities for digital learning in the classroom, since the old constraints of having to provide all learning technologies from central resources gradually fade away. Not that central resources are no longer required, since networks and cloud-based services become even more essential, but enabling a learner's own devices to be used for learning leads to greater efficiencies and digital inclusion.

We Capture Existing Technology and Best Practice for Learning

We should always be wary of reinventing the wheel. Educational research, including research into educational technology, has a long history and we would be foolish to embark on new technology-driven interventions in the classroom without taking full account of what we have learned in the past, and already understood about the processes of teaching and learning. The balance that needs to be struck is between embracing new ways of teaching and learning that are afforded by mobile devices, while holding to the underlying principles of good education. One very positive aspect of mobile technology is that it allows us to share the very best of existing practice using mobile technology. A good example of this would be the O2 Learn website (O2, 2012), which provides not only a video-sharing website for categorised educational content, but a tailored mobile app for easily capturing and uploading this content directly from the learning context.

Everything We Want to Teach Can Have a Mobile App

To some extent this is probably true already. Indeed, in some cases there are more apps (and other learning resources) for a given topic than you could possibly absorb. How many applications and websites teach basic mathematics, for example? We have seen the rise of online initiatives such as iTunesU and the MOOC (massive open online course) phenomenon, all of which threaten to overwhelm us with quantity without necessarily giving us the means to select the right applications for our own teaching or learning purposes. However, we can assume that over time the wisdom of crowds will assist us in finding the most suitable apps for a particular learning content; that, over time, the best apps will go viral while the weaker offerings fall by the wayside.

We Re-engage Students by Integrating Mobile Technologies into the Classroom

Lecture attendance in non-compulsory education has never been 100%, but gradually we have been eroding the reasons why students should come to class, particularly to large lectures (as opposed to smaller workshops, seminars, labs, etc.) by adopting LMS that often do no more that host a mass of uncontextualised material. The alternative to this is that we rethink our pedagogy by integrating mobile technologies so that face-to-face classes, even in large lecture halls, can become engaging and productive. We have already seen initiatives such as clickers and the “flipped classroom.” However there is huge potential to do much more in transforming our teaching philosophy to embrace mobile technologies in the classroom. The recent surge in BYOD initiatives suggests that many educators see the potential of mLearning as part of regular classroom delivery.

We Teach Things in a Practical Way That Could Previously Only Be Taught Theoretically

One of the major potentials of learning technologies is that they enable us to provide access to learning experiences that were previously too expensive, complex, dangerous or specialised to provide. We can now overcome these limitations by connecting learners to remote learning activities. It is already the case that distance students can perform engineering experiments remotely using remote data connections (Toole, 2011). Indeed, such virtual interactions need not take place only with physical contexts but also virtual contexts, performing experiments in virtual worlds (Vallance, Martin, Wiz, & van Schaik, 2010). As mobile technologies become more pervasive and seamless, new opportunities will arise for us to create practical learning experiences, accessed remotely through mobile devices.

In general, the future potential for mLearning is to enhance learning both inside and outside the classroom and workplace. By bringing devices into the classroom, we have the opportunity to transform formal education into a more engaging, relevant, collaborative and outward-facing activity. By taking learning outside the classroom using mobile devices, we have the opportunity to transform informal education, by turning the whole world into a learning space.

Top 5 Future Risks for Mobile Learning

While we are looking ahead, it would be unwise to focus only on the potential positives. We also need to guard against possible negative impacts. Some of the most important of these are outlined in this section.

Entrenched Digital Divides

Any approach to learning that involves technology may have an impact on digital divides. These divides can be quite subtle. They relate not only to access to equipment and connectivity, but also to the skills to make use of that equipment, and other aspects of the learners' situation that may impact on their ability to make meaning, to appropriate and to contribute. Wei, Teo, Chan, and Tan (2011) defined three levels of digital divide: the digital access divide, the digital capability divide and the digital outcome divide. Each influences the next and has an impact on learning. The message here is that we cannot address digital inequality just by providing access to technology. In addition, we need to address many aspects of digital literacy and digital citizenship.

Digital Distractions and Threats

Many schools have sought to ban mobile devices from the classroom on the grounds that they are purely distractions. For example, Greenwich Free school in London states in its public documents that "Mobile phones are a huge distraction in lessons, with pupils thinking about text-messaging, Twitter or Facebook in class instead of their work" (Greenwich Free School, 2012). This school is by no means unusual in this policy. In addition, fears about theft of devices and cyber-bullying exist too. A further dimension to distraction is the potential for information overload, distracting us from our learning objectives. We want to make meaning, not just accumulate data (Shum & Crick, 2012).

The Opposite of a Green Manifesto

Already there are more computers in landfill sites than on the desktop, and we continue to turn the planet to trash at a frightening rate. Every year, hundreds of millions of electronic items go to landfill in the United States and, globally, tens of millions of tons of e-waste go to landfill. To compound the problem, mobile phones have a particularly short lifespan. "Cellular contracts are 2 years for a reason; it takes approximately 1 year to recoup the costs of marketing, manufacturing, activating, and maintaining a cell phone, and the average cellphone lasts only 2 years. Battery life spans average 18 to 30 months" (Walker, 2010).

Even where electronic material is recycled, the impacts on developing countries can be disastrous, with dangerous recycling practices poisoning individuals and the environment (Bosavage & Maselli, 2006). Although many aspects of this negative environmental impact may be out of our direct control, we should nevertheless attempt to make wise choices in the purchase and use of mobile devices for learning, preferring devices that have low power consumption and a long service lifetime (e.g., have maintainable components), and that can be safely recycled — even if these may be more expensive to purchase in the first instance.

Uncontrolled, Misleading Effects on Outcomes

One of the issues facing us in evaluating the value or otherwise of mLearning is that we may find it hard to measure the real, as opposed to the perceived, impacts of new technologies. There are two well-known types of effect that can lead to false positives in assessing changes in practice or new forms of presentation. Various proposed effects, such as the "Hawthorne effect," suggest that it is hard to directly measure the real benefit of a change to a learning process because the context of the experiment itself may have effects that are separate from the actual intervention. The other effect that might be relevant is the "Dr. Fox effect," which is where people tend to give more value to something that is well presented regardless of the real value of the content being presented (Naftulin, Ware, & Donnelly, 1973).

Whilst the original Dr. Fox experiment, where an actor posing as an academic gave a highly engaging but meaningless lecture to a great reception, would now be hard to repeat without a considerable amount of fake material being posted on the Web, the same effect might be seen in the tendency for many student researchers to regard Wikipedia as the default first port of call for information and, further, to cite it with an uncritical eye. Thus, we should be careful not to allow the allure of new technologies and novel activities to suggest real teaching and learning benefits that may not really be present. We still have much to learn about instructional design, as new technologies present new challenges. In assessing new strategies, we must be mindful of drawing the right conclusions (Merrill, 2007).

Poor Return on Investment

Much literature (e.g., Brynjolfsson & Yang, 1996) has concerned itself with the "IT productivity paradox," referring to the elusiveness of productivity returns from information technology (IT) investments. Remarkably, it seems to be very hard to see where the return on investment comes from with IT. Whilst that debate is complex and ongoing, we should at least acknowledge that return on investment in learning technologies (indeed, any form of educational investment) is very important. Investment in education should see a return in terms of learning taking place, whether in a public school system, a university, or a corporate training environment. Large investments in educational technologies take funding away from alternative investments in education. It is therefore essential that the return on investment in any form of mLearning be at least as valuable as alternative forms of educational investment.

Researchers are failing in their duty if they do not consider what negative outcomes might flow from their work. Those of us who wish to promote mLearning need to be aware of its impacts on individuals, organisations and the environment that may be negative, and attempt to mitigate these. In addition, we need to ensure that our research methods are rigorous enough to avoid false positives, and ensure that any benefits we claim are in fact real.

Conclusion

Attempting to predict the future is an uncertain business, but an essential characteristic of the researcher is an interest in looking ahead to what we might be able to achieve. By addressing some major issues in mLearning as a series of "top fives," this chapter has attempted to contextualise both current and future concerns from both positive and negative perspectives.

- In addressing myths and misunderstandings, the chapter has outlined the areas where mLearning has been characterised in limited and unimaginative terms. By being aware of these assumptions, we may be able to more fully exploit mLearning in the future.
- In addressing mLearning innovations, the chapter has explored the broad range of affordances that are now offered by the types of mobile devices that are widespread in the learner community.
- In addressing future potentials, the chapter has shown how such technological progress, coupled with imaginative approaches to teaching, can bring true innovation to the classroom and to learning experiences in the wider world.
- Finally, in addressing possible future risks for mLearning, the chapter has attempted to raise awareness of potential negative effects, to assist researchers and educators in avoiding possible pitfalls of mLearning innovation.

In this chapter, we have seen the past contributions of mLearning, its most innovative characteristics, and some of its potentials and risks for the future. Whatever developments may come in technology and pedagogy, it is certain that the concept of mobility will have an increasingly important role to play in lifelong learning, as our experiences as learners and with the supporting technologies become more fluid, adaptive, collaborative and exploratory.

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Glossary

4G: The newest generation of mobile communications technology; allows data transfer to and from mobile devices at rates between 15 and 100 times faster than 3G networks

Advanced Distributed Learning (ADL) Initiative: One of several standardisation efforts in the field of technology-enhanced learning; see more at Advanced Distributed Learning

aggregation: The collection and integration of different data sources

ambient displays: Embedded indicators in everyday artifacts. Ambient displays can use multimodal information encoding as visual, auditory, haptic, gustatory or olfactory modalities.

ambient information: Information that is ubiquitous and embedded in every environment via the use of ambient displays

Ambient Information Channel (AICHE): A model and a methodology to design mobile applications and user interfaces that consider context of use. The AICHE focuses on designing integrated experiences that synchronise user services provided by mobile technology with the resources in the user's environment, situation or context.

app: Short form of *mobile application*

app market: A digital application distribution method designed to provide application software to users

Application Programming Interface (API): The specification of how the different software in a system should interact with each other to produce the desired outcome

artifacts: Physical objects in the environment of the user. These can be used as input and output channels and handlers for manipulating or perceiving ambient information.

audiobook: A recording of a text being read. It is not necessarily an exact audio version of a book or magazine.

augmented reality (AR): A live direct or indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data

blended learning: Education that combines face-to-face classroom methods with computer-mediated activities

Bluetooth: A short-range radio technology aimed at simplifying communications among Internet devices, and between devices and the Internet

bricolage: A concept that comes from the work of Claude Lévi-Strauss. It relates to finding resources (objects, tools, documents, etc.) and applying judgement to use them to build something you believe is important.

BYOD (Bring Your Own Device): In a learning scenario, means allowing learners to use their own personal devices

cellular: Frequency allocated for digital communications. Competing cellular systems include GSM and CDMA.

channel or ambient information channel: A two-way interaction channel for ambient information through which the user can interact with information in his or her environment or context

Code Division Multiple Access (CDMA): A digital wireless 2G technology that uses a spread spectrum technique to scatter a radio signal across a wide range of frequencies. CDMA carriers include Sprint, NexTel, Verizon, Alltel and Telus.

constructivist learning: Knowledge that develops through interactions with the environment

context: The situation or environment of the user. The literature distinguishes five main types of context in *AICHE*: identity, time, location, activity and relations.

cross platform: A technical approach to building software once, but allowing it to run on multiple operating systems

CSS (Cascading Style Sheets): A style language that describes how HTML mark-up is presented or styled. CSS3 is the latest version of the CSS specification.

DAISY (Digital Accessible Information System): A technical standard for digital audiobooks, periodicals and computerised text. DAISY is designed to be a complete audio substitute for print material and is designed specifically for use by people with "print disabilities" such as blindness, impaired vision, and dyslexia.

discovery learning: Knowledge discovered through active participation in the learning process

distance learning: A mode of delivering education and instruction, often on an individual basis, to students who are not physically present in a traditional setting such as a classroom. Distance learning provides access to learning when the source of information and the learners are separated by time, distance or both.

distributed cognition: The social aspects of learning, with the learner being in a relationship with physical things and other people in the environment

DITA (Darwin Information Typing Architecture): An XML standard that supports structured development and flexible delivery of documentation

educational technology: The study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources

eLearning: All forms of electronically supported learning and teaching, including educational technology. The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process.

EPUB (electronic publication): A free and open e-book standard of the International Digital Publishing Forum (IDPF). Files have the extension .epub. EPUB is designed for reflowable content, meaning that an EPUB reader can optimise text for a particular display device.

Experience API: The first project of the Training and Learning Architecture (TLA) effort of the *Advanced Distributed Learning (ADL) Initiative* to further the *SCORM* effort

Extensible Markup Language (XML): A mark-up language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable

findability: Within the usability and user experience communities, refers to the ease with which *mobile app* users can locate the specific content they seek

flexible learning: Making learning resources and methods increasingly distributed, varied and personalised across temporal and spatial spaces

flipped classroom: The use of online media to move the direct instruction aspects of education out of the classroom, and to use face-to-face time for more interactive, exploratory activities. The term was originally conceived by teachers Jonathan Bergman and Aaron Sams in the United States.

formal learning: Learning that takes place in formal educational settings

framing: The process of putting ambient information into a context and displaying pedagogically relevant frames or contextual information for stimulating learning processes

geocaching: A treasure-hunting game using a GPS to search for and hide containers (geocaches)

Global System for Mobile Communications (GSM): A 2G technology that is the de facto European standard for digital cellular telephone service, and is also available in the Americas. GSM carriers include AT&T, T-Mobile, SunCom and Rogers.

GPS (Global Positioning System): A worldwide satellite navigational system generally used for navigation and location determination

hashtag: The # symbol on a keyboard, used for *microblogging* purposes to add a meaningful tag to specific content

HTML (HyperText Markup Language): The mark-up language of the Web

HTML5: The latest iteration of HTML. It includes new features, improvements to existing features, and scripting-based *APIs*. It is designed to work on just about every platform and has been adopted by most mobile phone browsers. It provides for offline storage and does not require plug-ins.

IMS Learning Design (IMS LD): A formal technical specification proposed by the IMS Global Learning Consortium that defines a notation language for describing learning designs. It is based on the Educational Modeling Language proposed by the Open University of Netherlands (OUNL).

information and communications technology (ICT): A synonym for information technology (IT), but which is broader and stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals) with computers (including the necessary enterprise software, middleware, storage and audio-visual systems) to enable users to access, store, transmit and manipulate information

informal learning: Learning that takes place autonomously and casually

instructional design, or educational design: Descriptive model of educational processes

iPad: A type of *tablet* computer designed and marketed by Apple Inc.

iPhone: A type of *smartphone* designed and marketed by Apple Inc.

iPod: A type of portable media players designed and marketed by Apple Inc.

JavaScript: Programming language, part of the HTML5 framework

learning design: In reference to the teaching-learning process, the specific pedagogical strategy or practice that takes place within a unit of learning (e.g., an online course, a learning activity or any other designed learning event), aimed at addressing specific learning objectives for a specific target group in a specific educational context

learning orchestration system: A learning operating system that supports the implementation of educational designs

learning management system (LMS): The system that co-ordinates the activities when learners complete online, eLearning and mobile learning courses. The LMS administers the learning process, delivers the learning materials, tracks learners and allows learners to interact with the teacher and with other learners.

location-based learning: Learning that is connected to the physical location of a student

microblogging: A broadcast medium in the form of blogging. A microblog differs from a traditional blog in that its content is typically smaller in both actual and aggregate file size. Microblogs allow users to exchange small elements of content, such as short sentences, individual images and video links.

mLearning (mobile learning): All forms of learning that happen when the learner is not at a fixed, pre-determined location; also refers to learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies

mobile application (mobile app): A software application designed for use on *mobile devices* (such as *smartphones* and *tablets*)

mobile device: A small, hand-held computing device, typically having a display screen with touch input and/or a miniature keyboard, and weighing less than 0.91 kilograms (2 pounds)

mobile learning operating system: An information system that provides technical underpinning for educational applications, including standardised interfaces, data persistence and collaboration

mobile learning: See *mLearning*

mobile online course player: An *online course player* that can be installed and run in an optimal way to a mobile device

mobile technology: The technology used for cellular communication. Since the start of this millennium, a standard mobile device has gone from being no more than a simple two-way pager to being a mobile phone, GPS navigation device, an embedded Web browser and instant messaging client, and a hand-held game console.

MobiPocket: An e-book format based on the Open eBook standard using XHTML. It can also include *JavaScript* and frames.

MP3: A popular audio format

MP4: A popular video format

multi-device environment: Physical space that is equipped with interconnected *ICT* devices that provide an integrated information overlay

multiformat format, or multiple formats: An encoded content format for converting a specific type of data to displayable information

native app (or native development): Software developed in the coding language required for one specific mobile device. An example is Objective C (for iOS devices).

NFC (Near Field Communication): A standards-based, short-range wireless connectivity technology that enables convenient short-range communication between electronic devices; used for access control, mobile payments or peer-to-peer data transfer

OAuth: Authentication and Authorisation standard

online course player: A software programme for the delivery of online courses

open source: A philosophy, as well as pragmatic methodology, that promotes free redistribution and access to an end product's design and implementation details

orchestration: In the classroom, refers to the real-time management of and transition between multilayered activities (e.g., individual work, group work and class-level discussions), as well as management of multiple constraints (e.g., time and space constraints, curriculum and assessment requirements, and the energy level of the teacher)

PDA (personal digital assistant): A small, portable mobile device carried by people, often for business (e.g., *smartphone*)

personal computer (PC): Any general-purpose computer whose size, capabilities and original sales price make it useful for individuals, and which is intended to be operated directly by an end-user with no intervening computer operator

podcast: A type of digital media consisting of an episodic series of audio radio, video, PDF or EPUB files subscribed to and downloaded through Web syndication or streamed online to a computer or mobile device

problem-based learning: Learning in which a person develops knowledge by working on tasks and skills authentic to the environment in which those particular skills would be used

QR-code (Quick Response code): A two-dimensional code that enables mobile devices equipped with barcode readers to access additional information by scanning the code

Radio Frequency Identification (RFID): A technology similar in theory to bar code identification. It is used for everything from clothing tags and pet tags to missiles. RFID eliminates the need for line-of-sight reading that bar coding depends on, and can be done at greater distances than bar code scanning.

self-motivational learning: Learning in which a person is able to establish learning goals, increase effort and willingness to continue with learning beyond expectations, and devise more efficient strategies for learning. By adopting a self-regulated approach to learning, the learner gains increased confidence when a goal or task is reached.

sensor: A device for physical or virtual data collection. The sensor information can be used as metadata or as data in ambient information appliances.

sensor network: Network of data collecting ICT systems. A sensor network collects and integrates data from multiple sensing devices. A sensor network relies on pre-configured network connections between.

serious game: A game designed for a primary purpose other than to be purely entertaining

Sharable Content Object Reference Model (SCORM): An eLearning model of the *Advanced Distributed Learning* (ADL) Initiative. It integrates a set of related technical standards, specifications and guidelines designed to meet the SCORM's high-level requirements of creating accessible, interoperable, durable and reusable content and systems. SCORM content can be delivered to learners via any SCORM-compliant *learning management system (LMS)* that uses the same version of the SCORM.

Short Message Service (SMS): A text messaging service component of phone, Web or mobile communication systems, using standardised communications protocols that allow the exchange of short text messages between fixed-line or mobile phone devices

situated cognition: Relates to the idea that learning is best done in a real context of experience, in contrast to knowledge transmission that is given out of context. It has been associated with practical learning experiences such as the apprenticeship model and project-based learning.

smartphone: Mobile phone that includes advanced computing and connectivity functions beyond making phone calls and sending text messages. Smartphones have the capability to display photos, play videos, check and send email, surf the Web, and run third-party applications.

socio-constructivist learning: Learning in which knowledge is co-constructed interdependently between the social setting and the individual

stylus pen: A small pen-shaped instrument used to input commands to a computer screen, mobile device or graphics tablet. With touchscreen devices, a user places a stylus on the surface of the screen to draw, or taps the stylus on the screen to make selections.

synchronisation: The process in which metadata of different entities in *AICHE* applications are matched to filter the most fitting resources for a current context

tablet: A one-piece mobile computer operated primarily by touchscreen. The user's finger functions as the mouse and cursor, removing the need for those physical hardware components (necessary for a desktop or laptop computer), and the onscreen hideable virtual keyboard is integrated into the display.

transformative learning theory: The theory, first developed by Jack Mezirow in 1978, that dramatic fundamental changes can occur in the way we see ourselves and the world in which we live. The act of transformation in learning involves the individual becoming more critical and reflective in his or her approaches. The individual can learn to be more accepting of new ideas or concepts through the learning process itself.

video stream: Video that is constantly received by and presented to an end-user while being delivered by a provider

virtual education: A form of distance learning in which course content is delivered through the use of various Internet methods and resources, such as course management applications, multimedia and videoconferencing. Students and instructors communicate via these technologies.

virtual learning environment: An education system based on the Web that models conventional real-world education by providing learners with equivalent virtual access to classes, class content, tests, homework, grades, assessments and other external resources (such as academic or museum links). It is also a social space where students and their teacher can interact through threaded discussions or chat. It typically uses Web 2.0 tools for two-way interaction, and includes a content management system.

WebKit: Underpinning software code that powers the mobile browser in Apple (iOS), Android and recent Blackberry devices

Wi-Fi (wireless fidelity): Refers to a set of standards for devices that connect to a local area network using wireless technology

wireless: Means wireless communication, which is the transfer of information between two or more points that are not connected by an electrical conductor. The most common wireless technologies use electromagnetic wireless telecommunications, such as radio.

wisdom of crowds: Term from author James Surowiecki's book of that title (2005, Random House) which explores the idea that decisions made by groups may be better than decisions made by any single members of the group.

PERSPECTIVES ON OPEN AND DISTANCE LEARNING

INCREASING ACCESS THROUGH MOBILE LEARNING

We live today in a hugely "mobilised" world. Estimates put mobile subscriptions at more than 6 billion globally, with at least 75% of these being in developing countries. And nearly 2.5 billion of the world's population can now access the Internet, a third doing so through mobile devices alone.

As the use of mobile devices increases, so is interest in harnessing their power for education and training. Mobile learning (mLearning) is an emerging field that, with the availability of Open Educational Resources and rapid growth of mobile technologies, has immense potential to revolutionise education — in the classroom, in the workplace, and for informal learning, wherever that may be. With mLearning, education becomes accessible and affordable for everyone.

Many countries have major initiatives underway already to provide mobile technologies to their citizens. These are significant efforts, well aligned with the Commonwealth of Learning's mandate and UNESCO's goal of Education for All in the 21st century.

Increasing Access through Mobile Learning contributes to the advancement of the mLearning field by presenting comprehensive, up-to-date information about its current state and emerging potential. This book will help educators and trainers in designing, developing and implementing high-quality mLearning curricula, materials and delivery modes that use the latest mobile applications and technologies. The 16 chapters, written by 30 contributors from around the world, address a wide range of topics, from operational practicalities and best practices to challenges and future opportunities.

Researchers studying the use of mLearning in education and training, including as a means of supporting lifelong learning, will also find the experiences shared in this book to be of particular interest.

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