

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 e-learning 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 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 appears to be an ever-growing educational phenomenon. In the field of work-based education and workplace learning, mobile technologies such as cell phones, 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, e.g., Pachler, Pimmer, & Seipold, 2011a; Pachler, Pimmer, & Seipold, 2011b) and theoretical and conceptual discussions (Pimmer, Pachler, & Attwell, 2010). Before we elaborate our arguments, we will briefly problematise the notion of work-based mobile learning, a rather immature and emerging field of practice and research. In so doing, we combine and draw on approaches from work-based learning and mobile learning. Accordingly, 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. (drawing on Pachler, Bachmair, & Cook, 2010; Pachler, et al., 2011a)

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 primarily been used to reinforce traditional, instructional and teacher-centred pedagogical approaches (Attwell, Cook, & Ravenscroft, 2009; Hug, 2009); or in the words of media theorist 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 mobile learning: 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 mobile learning in the near future (Pimmer & Gröhbiel, 2008). Indeed, many of today's mobile learning 'solutions' tend to offer traditional e-learning content on mobile devices, as exemplified by the following case study:

Traditional approaches to mobile learning: a case from the finance sector (Swanson, 2008)

A big company from the finance sector piloted mobile learning 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 primarily intended to prepare learners for potential future use. Industrial standards such as 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’, for example during business travel. Effectiveness was measured by a summative assessment and a *"1.21 per cent increase in average competency score"* (Swanson, 2008) compared to the control groups was reported.

In Table 1 we briefly summarise the main characteristics of what we consider a traditional approach to (mobile) learning in work contexts:

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

Table 1 Traditional approaches to technology-enhanced and mobile learning in work contexts

Learning across contexts

We do not want to criticize learning in the form described in the previous section. However, we do suggest that many opportunities would be missed if mobile learning remained limited to the approach outlined above. We argue that the particular value of work-based mobile learning lies in connecting learning across different contexts and, thereby, bridging typical dichotomies of educational science. In the following we use 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 e-learning content to make it accessible on mobile devices might be the most intuitive approach to mobile learning. 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) or professional drivers (de Witt, Ganguin, & Mengel, 2011; Stead & Good, 2011). We agree, however, with Woodill, 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 simply repackage classroom materials to be read or played with on a smaller screen."* (2012). 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 et al. (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 handheld 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 and 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, et al., 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 primarily 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 they apply abstract knowledge in order to tackle immediate work challenges. An example is accessing codified knowledge from inter- 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 mobile learning strategy: they started to prepare a system to better support employees in the solving of immediate work-challenges, for example by 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 et al. (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 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 the provision of information directly at the point of care can augment self-directed learning practices. It has been examined, for example, how medical students in clinical workplaces use mobile devices to support learning and sense-making that arises within the immediacy of a situation by linking codified knowledge from internet sources with situated experiences (Pimmer, Linxen, Gröhbiel, Jha, & Burg, 2012). In another study, Grad et al. tie the impact of mobile clinical decision support systems to learning and practice improvement (Grad,

Pluye, Meng, Segal, & Tamblyn, 2005). A number of 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 the Google's goggles project appear to be promising, very little is known how this technology can be harnessed for work-based education.

Bridging individual and social learning

While the key functionality of mobiles is communication, i.e. social interaction, it comes as a surprise that so many mobile learning solutions – such as the above case study from investment banking – are primarily based on individual learning. In workplaces this is all the more questionable, since a great deal of competence development is rooted in "learning from other people" (Eraut, 2007).

In the IBM study reported in the previous section we have seen that employees access 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; experienced colleagues who can help, for example, with immediate client query issues. Interestingly, the study also revealed that – compared to 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 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 spreading of ideas and innovation beyond cliques or organisational units. This also seems to be in line with the importance that Hagel and Brown 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.*" (Hagel, et al., 2009); an approach that could also be realised by means of "people tagging", a particular form of social networking. Cook and Pachler (2012) exemplify on the basis of case studies 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

Compared to learning in formal training contexts, mobiles are much more widely used for learning in informal contexts. However, they can be used well to connect informal learning at work with formal learning contexts such as teaching in classrooms or mentoring. Lufthansa, for example, realised a course concept where junior managers received short tasks/assignments in the form of text messages directly at the workplace (very informal learning settings). The tasks aimed to apply theoretical knowledge from prior 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 knowledge from formal 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 into the classroom. For example, apprentices from different fields such as forestry, construction work, travel services, youth and leisure guides and catering answered daily question about their learning progress by means of their mobiles such as: *"I have felt myself needed today"*, or *"I have learned new things today"* (Pirttiäho, Holm, Paalanen, & Thorström, 2007). The questions were disseminated, collected and analysed by the teacher. Similarly, students could also enrich their online diaries by taking pictures, videos and sound with their phones and then debrief experiences in classroom settings. Evaluation reports suggest that such approaches are well received by students and can enhance education by setting learning goals, by supporting reflective practice and self-assessment (Mettiäinen & Karjalainen, 2011; Pirttiäho, et al., 2007). Similarly, Coulby et al. (2011; 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 e-learning content for mobile devices.

Beyond cognitive views, we suggest that the value of mobile learning 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, et al., 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., 2011; Coulby, et al., 2009). 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, use them for individual study and reflection prior to exams as well as *"proudly show it to the others"* (Pimmer, Linxen, Gröhbiel, et al., 2012); an example that emphasizes the importance of social dynamics and links situated, socio-cognitive learning with socio-cultural practices. There are a number of examples that foreground socio-cultural perspectives on mobile learning in workplaces: Chan (2011; 2011), for instance, reports that documenting and sharing authentic multimedia evidence of experiences of and at work enhanced apprentices' self-recognition, self-acceptance and processes of identity construction. Occupational identity trajectories, i.e., their

way of becoming central members 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 (2011). Also Wallace (2011) revealed how learners collected evidence of their professional competences by creating, sharing and reflecting multimedia learning materials. In so doing, identities of empowered learners were connected. She posits that mobiles supported "*making meaning and connection beyond the educational to the social.*" (Wallace, 2011). 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 to bridge social capital and, as shown in the IBM study, to 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, et al., 2007). From the perspective of constructivist learning theories, 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 e-learning in work-based settings are based on the individual study of educationally structured content in relatively formal learning settings in order to help learners in the "acquisition" of 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 mobile learning 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, for example by means of social mobile networking, or tagging and locating of experienced colleagues; (4) education across formal and informal settings, for example 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, (5) 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 and 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 foregrounded 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 2). An observation that is all the more important considering the fact that competence development rarely occurs from one moment to another but evolves over time through connected learning experiences (Barnes, 2008). In this sense, mobile learning in work-based education can bridge multi-faceted learning contexts by involving various and rich educational approaches and paradigm.

Contextual parameters	Traditional approaches	Enriched approaches: Connecting contexts	Examples
Content	Delivery	Creation <> sharing	<ul style="list-style-type: none"> Producing and sharing digital materials (audio, images, videos, text) of relevant work tasks
Proximity to work processes	Learning for work	Learning <i>for</i> work <> learning <i>at</i> work	<ul style="list-style-type: none"> Accessing resources for immediate problem-solving in the processes of work on demand (pull)
Social form	Individual	Individual <> social	<ul style="list-style-type: none"> Social mobile networking, people tagging: creating loosely-coupled expert networks and locating specialists for work challenges
Degree of formality	Formal	Setting: Formal <> informal	<ul style="list-style-type: none"> Documenting 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	<ul style="list-style-type: none"> Situated learning, meaning making, reflective practice Bridging social capital, spreading of innovation/ideas, peer-to-peer learning, active knowledge construction Identity formation, becoming a member of a professional community

Table 2 Contextual parameters to characterize work-based mobile learning 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 very much hope and believe that we have offered a jumping-off point as well as guidance for future projects in order to more comprehensively harness and "unlock" the value of mobile devices for work-based education.

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