Learning On-Demand Via Technologies that Facilitate Mobility: The Issues of Relevancy and Access

David Hung
Seng Chee Tan
Victor Chen

This article discusses the role of technologies that facilitate mobility in demand-driven learning situations. The focus is not on the technologies such as mobile devices per se, but to bring sense to the pedagogical dimensions of learning through such technologies. With all the hype on mobile technologies, there are few frameworks underpinning their educational applications. We propose a framework in which learning can be grounded on proximity of time, tasks, and usage (in terms of relevance); and proximity of peers, experts, appropriate materials, tools, and locality (in terms of access). This article is conceptual in nature and attempts to provide an educational rather than technical perspective on how mobile and wireless technologies can be adopted meaningfully for learning.

Introduction

In today’s world of e-learning and m-learning (mobile-learning), many corporations and other institutions are promising just-in-time learning for their personnel. Just-in-time learning is a worthy endeavor, providing timely instruction to employees at their desks or other workplaces. Just-in-time learning is commonly defined in terms of timeliness in providing instruction, even in face-to-face contexts, that is, a close proximity of available content or even personalized content to be accessed in the closest possible time, as soon as learning needs arise. For example, when an employee needs to know how to use a particular formula in a spreadsheet to compute the correlation of two sets of data, he/she accesses the online tutorial on the use of that formula. However, research literature has been lacking in the theoretical foundations of just-in-time learning. This article aims to deepen the discussion on just-in-time learning by looking into the literature on situated cognition and communities of practice. By matching the affordances of mobile technologies with the theory of situated learning, we propose some pedagogical principles on how mobile technologies can be adopted appropriately.

To concretize the discussion, we first paint a scenario of how mobile and wireless technologies can make a difference in professional development, in this particular case, teacher education.

A Case Scenario in Teacher Education

For many decades, teacher education conducted in teacher-education universities or institutes has followed the ‘out-of-workplace’ model. Preservice teachers are first taught in programs in the semester-university setting, and upon graduation find employment in K-12 schools. In the preservice curriculum, learning of theories (e.g., learning psychology, lesson planning, and classroom management) precedes practicum experience in schools. The practicum experience is regarded as an opportunity for the preservice teacher to link theories to practice. In short, the principles of teacher education are that theory precedes practice, and there is a temporal separation in the learning of theories and application in practice. These teacher-education institutes and universities are often unfortunately considered to be “ivory-towers” since what is ‘taught’ is increasingly perceived to be rather irrelevant in schools.

Now, let us look at an alternative model of teacher education. In Singapore, some beginning teachers start as contract staff in schools for about six months before they join the National Institute of Education (NIE) for teacher certification (the NIE is responsible for all teacher education in Singapore). We have come to realize that student-teachers who have school-based experience have a better appreciation of educational theories taught at NIE and are able to apply them more fluently to school practices. These student-teachers tend to perform better in their practicum. Based on this experience, we crafted the following scenario on how mobile technologies can further enhance this alternative model of teacher education.

Imagine that Clara, a novice teacher, starts her professional development in a school (we use the term novice teacher because ‘pre-service teacher’ will be a misnomer in this case). Clara starts as an observer in the school, following experienced teachers as mentors.
In Lave and Wenger's term, Clara begins as a legitimate peripheral participant in the community of teachers (see Lave & Wenger, 1991), much like the traditional craft apprenticeship model. In other words, she is not functioning as a licensed practicing teacher but as an apprentice observer.

The first few weeks of classroom observations begin to generate questions about classroom practices. For example, why is it that a group of students is so engaged in one lesson but seems to be fidgety in lessons conducted by another teacher? Clara is linked to a number of other novice teachers via an online forum facilitated by a teacher-educator at the university. She describes her observation and raises her questions in the forum via a personal digital assistant (PDA). One other novice teacher has a similar observation, and the online facilitator points them to several readings on motivation theories. Discussion on motivational theories then ensues. She also downloads a template that provides guidance on designing motivating learning activities.

Under the guidance of the mentor, Clara begins to conduct segments of lessons. Problems of classroom management become more obvious to her. For example, when she focuses on a group of hyperactive students, she neglects other students, and some students take the opportunity to misbehave. Immediately after the class, she discusses with her mentor the problems and how to overcome them. She also accesses an online case repository on classroom management. The cases are indexed with key words, which allow her to search for similar cases. She reads these cases and learns how other teachers deal with similar situations. Through an online tutorial, she is also introduced to Koumi's notion of "with-it-ness," which explains how she could manage minor misbehavior while keeping the other students on task. She then tries out the "with-it-ness," approach in her subsequent lessons.

After three months of practicing in school, Clara is given two days off every week to attend classes in a teacher-education college (in Singapore, the NIE). With her experience in the school, she is able to relate theories to practice and engage in deep discussion with classmates, who also have work experience in schools. The class becomes a community of practice (see Wenger, 1998), which focuses on improving classroom practices through application of theories and action research. The mobile technologies and online environments complement the face-to-face learning in the college. This community can potentially persist beyond the teacher certification course.

Key Principles in Situated Learning with Mobile Technologies

The above case scenario serves to illustrate two key principles in situated learning—Relevancy and Access.

We focus on these two principles as they are relevant to the use of mobile technologies. But, first, we would like to extend the concept of just-in-time learning to on-demand learning.

On-Demand Learning

To our mind, just-in-time is but one aspect of a broader notion of learning on-demand. To engage a learner on-demand is to keep the learner interested in or engaged in the learning process. To this end, Brown and Duguid (2000), in their book, The Social Life of Information, advocate that learning be demand-driven and that learning is a social act and an identity formation. Simply put, in order to engage a learner, the learning process should be derived from an authentic demand of interest to the learner. Educationally speaking, the issue is to design for learning situations where the learner's demands or needs for understanding concepts, phenomena, or solving problems can be met. In the process of being engaged in a particular task, problem, activity, or situation, he/she acquires the concepts, knowledge, and skills necessary for the completion of the task. Moreover, learning on-demand leads not only to conceptual knowledge and understanding, but also the experiences gained transform a learner's way of thinking or perspective towards a certain discipline or field of knowledge. Learners should be encouraged to take ownership of the learning and be given authority in addressing issues and problems. Learners, in addition, need to be accountable to one another for the work done, particularly in team work, and be given the available resources to manage the engaged learning process.

One may argue that it is not absolutely necessary to have on-demand learning, for example, we can learn a word from a dictionary but use it at a later occasion. Our stand is that the longer the separation between learning and application, the less effective is the learning. Beyond encouraging ownership of learning, on-demand learning enhances effectiveness of learning through situated cognition (see Brown, Collins, & Duguid, 1989). When a learner is motivated by an authentic demand of a situation, and if learning occurs in the same context, the contextual information may implicitly or explicitly be encoded as part of the knowledge learned. Brown, Collins, and Duguid (1989) argue that the contextual information is not ancillary to learning, but is an integral part of the knowledge. Decontextualized learning leads to inert knowledge that is not applicable in a real-world context. For example, a child who learns a new vocabulary from a dictionary often ends up constructing absurd sentences with that vocabulary.

In the case scenario noted above, through observation, Clara becomes curious about why students are more engaged in some lessons. With the guidance of the facilitator, she then starts to learn about
motivational theories. Clara initiates and owns the learning task. Clara also appreciates Kounin's theory of "with-it-ness" because she has personally experienced the classroom-management problem. She has a good sense of when to apply it in her next lesson. Her learning is situated in a real context.

Relevancy—Time, Task, and Usage Proximities

We have advocated that the concept of just-in-time learning should be extended to on-demand learning. In addition, we also argue that just-in-time learning only addresses the proximity in terms of time between needs to learn and the learning event. On-demand learning should entail the following aspects of proximity:

• Proximity in terms of time—that is, learning should occur close to the time when the needs arise in order to engage the benefits of the learning. For example, Clara accesses the case library of classroom management immediately after her lesson segment.

• Proximity in terms of tasks—that is, the learning task should be related to real demands, such as particular project or task needs for learners to achieve at specific milestones contexts. For example, Clara tries out the "with-it-ness" approach in her subsequent lesson, which is an authentic task related to a real demand.

• Proximity in terms of usage—that is, instead of a formal session that lasts for a few days, small learning episodes should be activated closest to the application of the knowledge or skills learned. In the case scenario, Clara learns the appropriate knowledge (e.g., one particular classroom management strategy) rather than taking a whole module on classroom management over a few months.

Only when all three factors are met will the relevancy of learning with real-life tasks be achieved.

Accessibility—Peers, Experts, Appropriate Materials, Tools, and Locality Proximities

In addition to the issue of relevancy, we argue that the effectiveness of learning can be further enhanced if the learner has access to the following:

• Proximity to peers—research on collaborative learning has yielded substantial findings on the benefits of learning with peers who provide different expertise and perspectives (Johnson & Johnson, 1997).

• Proximity to experts—experts, who usually possess implicit knowledge, help to provide insights and solutions to problems that are situational and usually not found in typical professional development programs.

• Proximity to appropriate materials—timely and personalized resources are essential for effective learning.

• Proximity to tools (applications)—tools play important roles in mediating or enhancing productivity, for instance, a simple job-aid helps remind a worker how to operate a simple machine.

• Proximity to virtual spaces or localities—virtual spaces or localities provide the learner a simulated context to better prepare the learner to function in an unfamiliar environment; for instance, many commercial flights show video prior to touch-down so that passengers learn what to do when they arrive in an airport.

The above five points of proximity suggest the conditions of a good learning solution. In the case scenario, Clara is linked to other novice teachers (proximity to peers) and a facilitator from the university (proximity to experts). She is able to access online information about motivational theories (proximity to appropriate materials) and to download the template (proximity to tools).

We have explicated the two key principles of on-demand learning (relevancy and access) and the corresponding proximity factors. In the next section, we will examine the affordances of mobile and wireless technologies and how these can be exploited for on-demand learning.

Mobile and Wireless Technologies

By mobile technologies we mean devices which can support anytime and anywhere computing through telecommunications (Attewell, 2005). Portable devices such as mobile phones, laptops, and personal digital assistants (PDAs) are increasingly accompanied by telecommunications capabilities with mobile phone integration. Today, we have telecommunication protocols which enable access to the Internet anywhere. Besides mobile telecommunication technologies, we have LAN-based wireless systems, which also enable mobility and flexibility of use (but the coverage of access is limited to the locality).

The key affordances of these mobile and wireless technologies are as follow (see Perry, 2003; Vahey & Crawford, 2003):

1. Connectivity—wireless and mobile telecommunication technologies enable learners to be connected from any location and at any time (just as our mobile phones enable us to communicate to anyone).

2. Communication—the technologies present several communications media, via text, voice, symbols and icons, and video.

3. Accessibility—today, we have easy access to the Internet virtually anywhere and anywhere through all kinds of mobile and wireless technologies.

4. Portability—we also have portable devices where flexibility of anyplace learning can occur.
The portable devices allow the users to carry them with ease.

5. Rich media—broadband communications increasingly enable us to transmit video-based data, allowing us to engage in multi-point video-conferencing. Multi-media rich interactions are now becoming common-place.

Table 1 summarizes how these affordances are applicable for on-demand learning.

**Table 1. Enhancing relevancy and accessibility through mobile devices.**

<table>
<thead>
<tr>
<th>Effective learning requirements</th>
<th>Benefits of mobile devices and wireless access</th>
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<tbody>
<tr>
<td>Proximity of time</td>
<td>Accessibility—with instant access to various resources, just-in-time learning can be achieved.</td>
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<tr>
<td>Proximity of tasks</td>
<td>Connectivity and Portability—mobile devices, with high portability, allow users to carry them anytime, anywhere without posing impediment in the work environment; learners can undertake learning tasks by being connected to relevant people and resources.</td>
</tr>
<tr>
<td>Proximity of usage</td>
<td>Connectivity and Portability—likewise, the portability of mobile devices provides connection to assistance anywhere and anytime when the learners apply the skills and knowledge.</td>
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<tr>
<td>Proximity of peers</td>
<td>Communication—through the use of mobile communication technologies, collaboration with colleagues or peers can be made more relevant and available.</td>
</tr>
<tr>
<td>Proximity of experts</td>
<td>Communication—it is now easier to bring (together a team of experts (i.e., a larger pool of experts) to accomplish the learning needs, rather than just focusing on any one person, with all the required expertise sometimes difficult to find.</td>
</tr>
<tr>
<td>Proximity of materials</td>
<td>Connectivity—through the Web and with portable devices, we now have more timely and personalized resources; however, these materials have to be screened for appropriateness and relevance.</td>
</tr>
<tr>
<td>Proximity of tools</td>
<td>Connectivity—with mobile and wireless technology, we can now gain access to learning through a variety of tools.</td>
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<tr>
<td>Proximity of virtual spaces</td>
<td>Connectivity and rich media—through the use of mobile technologies, we can have a range of localities, contexts, and situations where we no longer need to confine learners to a particular learning context. Communication can be achieved through rich media and multi-modalities. In the past, we had to confine learners to particular place, but now learners can be distributed in different locations.</td>
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**Discussion**

Under the strong influence of institutionalized learning, professional development (like teacher education) has been confined to classrooms, which are removed from the context of the workplace. We have examined two key aspects of on-demand learning that can be facilitated through mobile and wireless technologies: relevancy and access. Using activity theory as a framework (Engeström, 1987), we highlight how mobile and wireless technologies can support on-demand learning (see Figure 1).

In Figure 1, learners can be organized around a whole-group or in sub-teams or sub-groups. These sub-groups or the group as a whole access all kinds of resources (information, persons, experts, localities, and tools) in order to achieve the target goals of the learning. The learning goals ultimately will converge in practical outcomes relevant to the learners’ work contexts and demands.

Of interest to us in particular is the access to relevant materials, such as cases or stories pertinent to learners as they engage in context-dependent situations. Cases and stories are still relevant in context-rich situations as supporting resources for problem-solving. Stories and narratives are mentioned as important artifacts of knowledge management within organizations. Cases enable learners and practitioners to compare and contrast real-life situations with the ones they are currently undertaking. These case stories can be multimodal in the form of rich videos, texts, and others.

Researchers and designers believe that instructional materials supporting ill-structured problem-solving skills should incorporate cases that represent (as closely as possible) real-world cases and problems in that particular domain (Jonassen, 1997). The use of stories or cases in problem-solving education increases problem-solving skills, helps address misconceptions, and contributes to the changing of attitudes (Brown, 1992; Hernandez-Serrano, in press). Case libraries made available to students while they are learning can scaffold memory by providing representations of experiences that learners have not had (Hernandez-Serrano, in press). These cases can represent complexity in learning situations by providing multiple perspectives, themes, or interpretations to the problems being addressed or examined by the learners. The
Proximity to Tools and Materials

Proximity to time, skills, and task

Learners or trainees in on-demand training

On-demand learning

Rules

Community

Division of labor

Proximity to peers, experts, and virtual spaces

Figure 1. How learning on-demand works.

The concept of knowledge management supports the use of cases even for practitioners on the job (Lesser, Fontaine, & Slusher, 2000).

To summarize, mobile technologies can possibly facilitate the gradual re-definition of kinds of learning possibilities or modes. We need to recognize that in any system there are inherent advantages and disadvantages. A lack of face-to-face interactions will lose the tacit dimensions of interactions and knowledge constructions. Face-to-face interactions where bodily cues predominate are still a necessary part of learning.

The key question which we are confronted with is: How do we provide instruction in ways that are most relevant in terms of timeliness, access to information, resources, persons, localities, and task outcomes and skills? With technological advancements in devices which facilitate anywhere and anytime learning, we need not constrain our instructional strategies to traditional modes of instruction and delivery. The flexibility in terms of delivery, access, and relevancy to learners should now be reconceived.

It would seem to us that the gap between training and just-in-time learning is closely being bridged. In the past, training was seen as learners or trainees attending a formal course somewhere. Now that instruction is being delivered to learners where they are, issues of learning and training are being blurred. Moreover when one is to be engaged in a particular work task, and he or she accesses resources and information to assist in the engagement of the task, albeit the need to be trained to use certain tools, he or she is learning rather than being trained. In other words, training presupposes a certain mode, whereas learning can be anywhere and at anytime.

This convergence can be seen from the perspective that the center of focus is no longer the instructional goals conceived by the trainer or instructor, but instead arises from the need or problems encountered by the trainees. In this setting, instruction and content take a secondary role and the problem features become central. Content and instruction become the means to an end.

Conclusion

Learning on-demand through mobile technologies has now opened up the channels for flexibilities in time and space interactions. Formerly, learning was bound to formal traditional settings, and gradually e-learning has made available instruction to the workplace. Teacher-education is one example in which wireless and mobile technologies can make a difference to the current conventional methods of professional develop-
ment. In principle, on-the-job learning (with access to mobile technologies) is useful for skills learning, whereas formal settings such as universities are useful places for reflection and knowledge. Now with m-learning technologies, the individual learner need not be constrained to any particular location space. Problems and situations that are developed in situ can be addressed and communication made to anyone accessible there and then (except for time zone considerations across continents). Mobile technologies coupled with small and portable PDA and communication devices now enable the learner to learn in anywhere and anytime modes.

However, anywhere and anytime on-demand learning assumes that the learner is sufficiently mature and responsible in seeking information and knowledge. The social implications of persons and experts being accessed anytime and anywhere can also be an issue which may have to be considered. In addition, the costs involved for tele-communications have to be sufficiently low to facilitate the kinds of interactions discussed. The entire basis of our conceptualizations centers on making learning more relevant to real authentic needs and access to persons and resources more timely. Obviously, one may be questioning whether, in learning, there is such an immediate urgency, where persons and resources need to be accessed through such technologies. Some critics would argue that perhaps there is nothing in education that is quite so time-critical. We acknowledge that learning in general is not as time-critical as stock-market data, but we sense that the quality of learning interactions would be enhanced through timeliness. Research into how such timeliness would affect learning and its outcomes is necessary.

The way ahead for learning is interesting. Mobile technologies help to re-define the kinds of learning modes and possibilities available. We conjecture that the drive towards anywhere and anytime learning through mobile technologies would have to be balanced with face-to-face contact with participants and facilitators. Indeed, we still exist in a very social-oriented world, where meetings with clients, peers, and others remains crucial. Nevertheless, we hope that the thoughts documented in this article present ideas for further deliberations.

#### References


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**Additional Resources**


This paper describes a study of how mobile devices are used for teacher training. The project aims to create a flexible teaching environment which will enable access to information using different devices, and support learning in a variety of situations. The pilot study was carried out at the Department of Home Economics and Craft Science at the University of Helsinki, where the supervising teacher and trainee students discussed and shared their ideas about teaching methods through mobile devices and use of a short message service (SMS) and digital pictures. Positive feedback from the teacher and trainees was reported.


This BECTA report aims to identify values in the use of small, handheld computing devices for both teachers and pupils in English schools. It discusses the affordance of PDAs and the potentials of PDAs for enhancing efficiency for leaders and teachers. It was reported that the potential of PDAs to help either teachers in their teaching or pupils with their learning is less clear, but some very positive examples are emerging.