

Chapter 3

Designing Effective Pedagogical Systems for Teaching and Learning with Mobile and Ubiquitous Devices

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ABSTRACT

The aim of this chapter is to explore issues in effective system design to bring about pedagogically sound learning with mobile devices, including the emerging generation of new devices. The authors review pedagogical models and theories applicable to mobile learning (or m-learning) and ubiquitous learning (or u-learning, also sometimes called pervasive learning, or p-learning), consider the technological support available, and describe scenarios and case studies that exemplify the achievements and challenges for each paradigm. They will also consider possible abstractions that relate ways in which learners can work within varied pedagogical model(s) to make use of relevant supporting technologies, e.g., the notions of “personal learning workflows” and “group learning workflows.”

INTRODUCTION

The concept of ‘ubiquitous computing’ was first articulated by Mark Weiser to mean technologies

that are being used unconsciously as they weave themselves into the fabric of our everyday lives (Weiser, 1991, 1996). In this regard, ubiquitous computing is ‘calm technology’ (Weiser and Brown, 1996). O’Malley & Fraser (2006) described it simi-

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larly as ‘technology that is so embedded in the world that it disappears’ (p12). When computing becomes ubiquitous, it has the capacity to support ubiquitous learning (*u-learning*, also sometimes called pervasive learning, or *p-learning*), that is, learning whenever and wherever it might take place. ‘Calm’ or invisible technology does not occupy the learners’ attention all the time but is able to be moved seamlessly and effortlessly between the learners’ central and peripheral attention. Hence, *u-learning* is not constrained by physical space, plans or timetables but is pervasive because it can occur anywhere at anytime and is supported rather than constrained by the technology that mediates it.

In this chapter, we discuss the concept of *u-learning* and its relationship to mobile learning (*m-learning*). We discuss mobile devices as potentially ubiquitous learning tools. We review theories and pedagogical models applicable to *m-learning* and *u-learning* and consider possible abstractions that relate ways in which learners can work within the pedagogical models to make use of relevant supporting technologies, for example, the notions of ‘personal learning workflows’ and ‘group learning workflows’. We propose some scenarios and describe the systems architecture associated with them that would be required to bring about learning with mobile devices.

UBIQUITOUS AND MOBILE LEARNING

Ubiquitous learning is characterised by two dimensions: (1) it is not constrained by physical space, plans or timetables but is pervasive and occurs anywhere at anytime and (2) as a consequence of the distributed nature of the immediate access to a variety of sources of information or means of reflecting on experiences in interaction with others, ubiquitous learning is characterized by the transformation of understanding and the ability to question experiences and information.

Informing this view and in line with the views of Schenker, Kratcoski, Lin, Swan and van ‘t Hooft (2007), we understand learning as ‘the processing of encountered information [extended to include experiences, values or representations] that leads to changes in knowledge, skills, beliefs, abilities, and behaviours’ (p172). The notion of ‘ubiquitous’ learning builds on this to emphasise how this processing can occur through a variety of modes and modalities unconstrained by time and location. Because of their capacity to situate the experiences and transforming reflections in both the immediate and more removed contexts, mobile technologies offer a powerful means to enable ubiquitous learning in being able to provide a portable, interactive learning environment capable of both multimedia functions and Internet access and supporting both self-directed, independent learning and interactivity with others. Consequently, mobile technology should be able to foster active and creative learning as it is capable of creating opportunities for students to collaborate with peers in project work (e.g., via phone to phone Bluetooth, or IR beaming) and to undertake independent research (via wireless networking) and be engaged in problem solving in real-life contexts. Its portability allows for context-based data collection and ‘just-in-time’ learning.

At a broad level, *u-learning* encompasses electronic learning (*e-learning*) usually associated with *m-learning*. *M-learning* is defined by different people differently. Keegan (2005) has a more technology-centred definition of *m-learning* stating that it is the ability of mobile devices (PDAs, mobile and smart phones) in providing education that constitutes *m-learning*. Considering *m-learning* from a more learner-centred approach, Georgiev et. al. (2004) define the term as the ability to learn everywhere, anytime without the need for permanent physical connections to cable networks. Vavoula and Sharples (2002) suggest that learning is closely linked to mobility and that there are three ways in which learning can be

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