

## Chapter 5

# Adaptive and Activity–Oriented Pervasive Learning Systems at Workplace Based on Service Oriented Architecture

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### ABSTRACT

*In this chapter, the authors' main work is to propose a development process of pervasive work-based learning systems from design to execution based on an activity-oriented approach. The authors focus especially on pervasive TEL (technology-enhanced learning) systems in learning situations at the workplace. They introduce a context-aware scenario model of corporate learning and working activities in e-retail environments such as shops and hypermarkets. This model integrates contextual information into scenarios and select how to perform activities according to the current situation. In order to execute their scenario, they outline the semantic description of learning components (resources, services and activities) to enable their selection to achieve the goals specified for learning and working activities. Thus, an adaptive mechanism enables the selection of the relevant learning components for the current situation. This can be solved thanks to a service oriented architecture that consists of an infrastructure for service management and execution in e-retail environments.*

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## **INTRODUCTION**

Nowadays, TEL systems must have the capability to reuse learning resources and web services from large repositories, to take into account the context and to allow dynamic adaptation to different learners based on substantial advances in pedagogical theories and knowledge models (Balacheff, 2006). This is particularly true of mobile learning, where context is variable. The reuse of learning resources and web services requires interoperability at a semantic level. In other words, it is necessary to have a semantic web approach to design TEL systems. Moreover, knowledge models and pedagogical theories can be fully represented by means of a semantic web approach. In the mobile learning area, a number of terms are commonly used: mobile, pervasive and ubiquitous learning systems (Brodersen, Christensen, Gronboek, Dindler, & Sundararajah, 2005; Hundebol & Helms, 2006; Sharples, 2005; Thomas, 2007). In computer science, mobile computing is mainly about increasing our capability to physically move computing tools and services with us. The computer becomes an ever-present device that expands our capabilities by reducing the device size and/or by providing access to computing capacity over the network (Lyytinen & Yoo, 2002). In mobile computing, an important limitation is that the computing model does not change while we move. This is because the device cannot obtain information about the context in which the computing takes place and adjust it accordingly. In pervasive computing, the computer has the capability to inquire, detect and explore its environment to obtain information and to dynamically build environment models. This process is reciprocal: the environment also does it and becomes “intelligent”. In ubiquitous computing, the main goal is to integrate large-scale mobility with pervasive computing functionalities.

In this chapter, we consider that mobile, pervasive and ubiquitous learning systems have the properties of mobile, pervasive and ubiquitous computing systems respectively. We focus our

attention on pervasive learning systems. Mobile learning is not just about learning at anytime, at any place and in any form using lightweight devices, but learning in context and across contexts. It is best viewed as providing mediating tools in the learning process (Sharples, 2006). Many definitions of pervasive learning are given in the literature (Bomsdorf, 2005; Hundebol & Helms, 2006; Jones & Jo, 2004; Thomas, 2007). One useful definition is that a “pervasive learning environment is a context (or state) for mediating learning in a physical environment enriched with additional site-specific and situation dependent elements – be it plain data, graphics, information -, knowledge -, and learning objects, or, ultimately, audio-visually enhanced virtual layers” (Hundebol & Helms, 2006). One could consider pervasive learning as an extension to mobile learning where the roles of the intelligent environment and of the context are emphasized (Laine & Joy, 2008). In pervasive learning, computers can obtain information about the context of learning from the learning environment where small devices, sensors, pads, badges, large LCD screens, people, and so on, are embedded and communicate mutually. The physical environment is directly related to learning goals and activities. The learning system is dynamically adapted to the learning context. However, the context is dynamic and “unpredictable”. That is to say we can never guarantee the presence of a context feature or dimension in the current context. This issue can be regarded as how the system takes into account the management of context changes for adaptation. Consequently, a pervasive learning system needs to have appropriate software architecture and adaptive mechanism to support these dynamic properties.

At workplace, learning can occur in purposeful situations in which there is an explicit goal to learn as well as in incidental situations in which there is no explicit learning goal or interest. Working involves an activity or a related set of activities that require effort and are aimed at achieving business objectives. Learning empha-

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