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This paper appears in the publication, International Journal of Mobile and Blended Learning, Volume 1, Issue 3
edited by **David Parsons © 2009, IGI Global**

An Adaptive and Context-Aware Scenario Model Based on a Web Service Architecture for Pervasive Learning Systems

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ABSTRACT

Pervasive learning will become increasingly important in technology-enhanced learning (TEL). In this context, development efforts focus on features such as context-awareness, adaptation, services retrieval and orchestration mechanisms. This paper proposes a process to assist the development of such systems, from conception through to execution. This paper focuses mainly on pervasive TEL systems in a learning situation at the workplace. We introduce a context-aware scenario model of corporate learning and working scenarios in e-retail environments such as shops and hypermarkets. This model enables us to integrate contextual information into scenarios and to select how to perform activities according to the current situation. Our pervasive learning system is based on a service oriented architecture that consists of an infrastructure for service management and execution that is flexible enough to reuse learning components and to deal with context changes that are not known in advance and discovered on the fly.. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Pervasive Learning; Task/Method Paradigm; SOA

INTRODUCTION

Nowadays, technology-enhanced learning (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 article, 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 learn-