Context-Aware and Adaptive Units of Learning in mLearning

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ABSTRACT

In technology-enhanced learning, the use of mobile applications is increasing, which improves students’ learning experiences, allowing them to carry out daily activities anytime, anywhere. However, the majority of the available learning contents have been designed for desktop computers; thus, accessing that information is limited by the technical capabilities of mobile devices. As a result, students might lose interest and motivation to learn using their mobile devices if content adaptation and learning personalization processes are not appropriately designed. In this paper, the authors present a context-aware adaptation architecture for mobile learning. In the architecture, two mechanisms based on conditional statements from the IMS Learning Design specification and a transcoding mechanism are presented. Moreover, which learner’s contextual information can be represented to design the learning process and retrieved to adapt activities and resources is explained by the description of a context-aware mobile-assisted second language learning scenario.

Keywords: Context-Awareness, Education, IMS Learning Design, Learning Design, Mobile Content Adaptation, Mobile Learning

INTRODUCTION

The continuous increase in the range of mobile, wireless and interconnected technologies in learner’s environment allows education to be digitally linked to the learners’ experiences across with and between multiple locations and learning situations. Moreover, the widespread ownership of mobile devices has lead to an increased interest to a mobile learning (m-learning), namely, as “the process of learning and teaching that occurs with the use of mobile devices anywhere and anytime” (Traxler, 2009; Kukulska-Hulme, 2009a).

Mobile devices combine tools and services that can be accessed anytime and anywhere, and because of this advantage people have tried to integrate them into their daily lives. Nevertheless, the application of m-learning in education has been focused only on using those tools and services in traditional learning settings rather than on personalizing and adapting the learning process considering situations of authentic learning where learner’s real-life contexts and settings different from formal learning can be exploited.

An important success factor for m-learning is the pedagogically meaningful and technically feasible process of learners’ contextual information. While the formal definition of context is
still an open issue (Luckin, 2010), contextual information in technology-enhanced learning (TeL) involves the information that characterizes a learners’ given situation.

In m-learning situations, completion of activities may be supported by the interaction with resources such as surrounding people (learner peers, family, tutors, experts, etc.), digital devices (mobile technologies, ambient intelligence technologies, etc.) and non-digital resources (books, documents, etc.). These resources have the potential to enable teachers to take advantage of each learning situation by means of designing the learning process exploiting different parameters of the learner’s context.

In order to achieve truly mobile and personalized learning, adaptation processes for context-aware learning design and delivery of learning contents and activities are needed.

In our research work we are focusing on studying the benefits that contextual information, existing on different learning situations and interactions, can provide to the learning design process, so as to achieve a personalized and adaptive m-learning. We are considering information such as the characteristics of the learning place and its physical conditions, the spare time used to learn, the capabilities of the mobile devices, the contributions of the surrounding people and the individual learning interests, preferences and needs in a particular moment in order to design context-aware m-learning and deliver context-aware and adapted activities and contents to the learner in the right time and the right place.

In this article, how contextual information can be considered in the learning design process to deliver adaptive contents and activities is presented. To this end, the structure of the IMS-LD specification (IMS, 2003) is considered to present the architecture of an adaptation process that includes identifying elements to describe the contextual information that could be integrated to the description of pedagogical models based on m-learning scenarios, and adapting learning contents (referenced in the IMS-LD) in order to deliver them to the learner’s mobile device. Moreover, a second language learning scenario that benefits from the contextual information and m-learning characteristics is described as a case study to explain how contextual information can be represented to design the learning process and used to support and assist personalized and adaptive m-learning situations.

The architecture includes adaptation mechanisms executed at two different times: design-time and run-time. Through these mechanisms the contextual information can be retrieved, multimedia resources included in learning design can be used, conditions and adaptation rules can be evaluated, actions that enhance the presentation of resources and tools can be performed, and appropriate transformation jobs can be executed to automatically deliver content adapted to the student’s preferred device.

This article is organized as follows. The next section describes how contextual information can be represented in the learning design process. Mobile activities and content adaptation mechanisms and approaches are explained as background. A context-aware approach for m-learning is described in a second language learning case study. The next section presents the architecture based on processing the contextual information, and some testing results of a transcoding mechanism implemented are presented. Finally, some conclusions are drawn and future work is proposed.

CONTEXT-AWARE LEARNING DESIGN

Context has diverse interdisciplinary interpretations. However, there are many points of overlap between each discipline in particular where digital technology is a feature of research (Luckin, 2010). In computer science discipline the context is properly defined by Dey and Abowd (2000) who states that context is “any information that can be used to characterize the situation of an entity” understanding the term “entity” as anything relevant participating in the interaction between an user and a system, such as a person, a place, or an object including the user and the system.
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