Six Scenarios of Exploiting an Ontology Based, Mobilized Learning Environment

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ABSTRACT
In this article, six different exploitation possibilities of an educational ontology based, mobilized learning management system are presented. The focal point of this system is the educational ontology model. The first version of this educational ontology model serves as a foundation for curriculum development and adaptive knowledge testing. The extended educational ontology model is the foundation of a personnel selection and training system, developed by the OntoHR project. This system reveals the candidates’ competence gap and the missing learning outcomes of their qualifications in the light of a particular job role (Information System Analyst). Within the frame of the Contsens project, the educational ontology model supports a context sensitive and location based learning content delivery. The results of these projects can be combined in an educational ontology based, mobilized selection and learning management system, built on transparent content and location dependent curricula.

Keywords: Adaptive Testing, Competency Matching, Content Management, Contextual Learning, Human Resource Management, Knowledge Management, Mobile Learning, Ontologies

INTRODUCTION
Representing content in an appropriate format, which is tailored down to the learner’s context, is a great challenge of educators. As there are no identical learners with identical educational needs, the problem of providing uniquely composed and personalised learning material is an ongoing issue (Soloway et al., 1996; Watkins, 2010). This paper describes a framework using ontologies for contextual learning content management, which also serves as a domain for research activities in the field of mobilised learning content management. The authors have been working on this issue for several years (Kismihók, Kovács, & Vas, 2009; Kismihók & Vas, 2009; Vas, 2007; Vas, Kovács, & Kismihók, 2009a) in order to establish a robust theoretical and empirical foundation for their research and teaching activities with the help of mobilised educational technology.

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The structure of this article is as follows: First, some important theoretical issues regarding ontologies and adaptive learning content delivery are discussed. This is followed by coverage of the research context, which encompasses six main areas of research and practice: curriculum development, adaptive testing, learning technology selection, selection and recruitment in Human Resource Management (HRM), competency matching and context based learning.

In this research context, curriculum development and adaptive testing methodologies are elaborated based on an ontology-based approach. This, on the one hand, provides support for capturing regularities in a single framework to model the curriculum content management requirements at multiple institutions; and on the other hand, by its inference capabilities effectively supports adaptive knowledge testing. These ontology-based applications (by extending the ontology model with competency descriptions) have been applied to developing HRM applications in the context of the OntoHR project that support job-knowledge based assessment of applicants for the purpose of personnel selection. This application also enables the conversion of vocational education qualifications into job related competencies. Furthermore, as will be demonstrated with the case of the Contsens project, the ontology based curriculum has been extended with contextual information. With the help of a mobile device the system automatically pushes content towards the learner. In all these cases the ontology model serves as a bridge to connect these diverse applications and enable their interoperability.

Finally, the relevant technical and theoretical challenges that the authors had to deal with are presented. At the end of the paper conclusions are drawn and some future research proposed.

**ONTOLOGIES AND ADAPTIVE LEARNING CONTENT DELIVERY**

Adaptivity and semantic technology are used in several ways in educational content delivery. These ways include interoperability, collaboration and context aware content management. Examples show that one way of using ontologies in a learning system is supporting interoperability between particular educational platforms and systems (Aroyo et al., 2006; Moreale & Vargas-Vera, 2004). When it comes to collaboration the notions of ontology based applications in eLearning systems show that semantic-enabled annotation and knowledge management systems provide flexible, real-time support for collaborative learning tasks (Yang, Chen, & Shao, 2004).

Context awareness can be treated as a problem of processing sensory information coming from mobile devices and transforming this information into a well defined context, which can be done in several ways, including ontologies and clustering maps (Flanagan, 2005). Furthermore, ontologies can also be useful for context identification and reasoning (Hu & Moore, 2007), thus there are also attempts to use ontologies for modelling not only the learner’s context but also the content’s context in order to provide more user specific services in ubiquitous learning environments (Yang, Huang, Chen, Tseng, & Shen, 2006).

Based on the above mentioned topics, several ontology supported solutions are available for content representation. Emerging from traditional eLearning, the OntoEdu architecture aimed to enhance content reusability together with device and user adaptability (Guangzuo, Fei, Hu, & Shufang, 2004). The SPIRIT project used ontologies for describing the spatial structure of places, this structure being used for information retrieval (Jones et al., 2002). The
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