Chapter 8

Orchestrating Ontologies for Courseware Design

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ABSTRACT

This chapter presents an approach aimed at creating teaching strategies for e-learning based on the principles of ontological engineering and cognitive psychology. The proposed framework is important for many reasons. It is targeted at the development of methodologies and related technologies that can scaffold the process of knowledge structuring and orchestrating teaching ontologies for courseware design. The orchestrating procedure is the kernel of ontology development. Ontologies that describe the main concepts of exemplary domains are used both for teaching and assessment techniques. The main stress is put on using visual techniques of mind-mapping and concept mapping as a powerful mind learning tool. Cognitive bias and some results of Gestalt psychology are highlighted as a general guideline. The ideas of balance, clarity, and beauty are applied to the ontology orchestrating procedures. The examples are taken mainly from the course in C-programming, and in the foundations of intelligent systems development.

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INTRODUCTION

During the last decade, visual knowledge representation has become one of the key considerations in e-learning methodology and it is heavily associated with ontology design and development. Alongside this, so-called teaching and learning ontologies have arguably come to play a central role in courseware content. These ontologies, which are built on conceptual skeleton of the teaching domain, might serve various purposes such as better understanding, knowledge sharing, and collaborative learning, problem solving, seeking advice, or developing competences by learning from peers. Recently, ontological engineering perspective has gained interest in the domain of computer-aided learning and cognitive psychology involving the study of the structure and patterns of knowledge. These studies
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This chapter traces the cognitive foundations of educational design using the methods of structured ontological engineering. The purpose of the described methodology is to provide teachers and learners with the distinct recommendations in ontology design and orchestrating for better knowledge transfer and sharing.

BACKGROUND

The idea of using visual structuring of information to improve the quality of student’s learning and understanding is not new. For more than twenty years concept mapping (Sowa, 1994; Jonassen, 1998; Conlon, 1997) has been used for providing structures and mental models that support the process of teaching and learning. As such, the visual representation of general domain concepts facilitates and supports student understanding of both substantive and syntactic knowledge. Many teachers, especially those who teach sciences and engineering courses, operate as a knowledge analysts or knowledge engineers by making visible the skeleton of the studied discipline and showing the domain’s conceptual structure (Kinchin, 2006). Often this structure is called “ontology”.

However, ontology-based approach to knowledge representation in pedagogy is a relatively new development. Ontology is a set of distinctions we make in understanding and viewing the world. There are numerous definitions of this milestone term (Neche et al, 1991; Gruber, 1993; Guarino et al, 1995; Gomez-Peres, 1999). Together, these definitions clarify the ontological approach to knowledge structuring while giving enough freedom to open-ended, creative thinking. So, for example, ontological engineering can provide a clear representation of a course structure, main concepts, approaches, terms and their inter-relationships. Many researchers and practitioners argue about distinctions between ontology and a conceptual model. We suppose that ontology corresponds to the analyst’s view...
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