Ontology-Based Conceptual Domain Modeling for Educational Portal

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Abstract

The paper describes the ontological approach to the visual knowledge structuring for the e-learning portal design and development. We will discuss why these topics are increasingly important and describe the experience of ontology developing for Knowledge Engineering courses based on educational course for both undergraduate and master students of Saint-Petersburg State Polytechnic University and Saint-Petersburg State University. We will also describe “OntolingeWiki” tool for creating ontology-based e-learning portals.

1. Introduction

While the development of information and communication technologies is becoming more and more intense, e-learning struggle to fulfill increasing needs of modern education. It has to be effective, well designed, not expensive, reusable, and fast in development. There are social changes which influence that too: as society becomes more and more visually dominated educative systems need to become more up-to-date, flexible and adequate [7].

The use of ontologies in building educational systems is not really a new concept. They have often been used to represent different concepts or subject matters to be taught in a course [1].

However, the importance of specification and structuring the content and its visual presentation – followed with such connected issues as design, adaptation and usability has been underestimated to a certain extent until recent times as the researchers were far more concerned about how to educate (with methods of instruction or reasoning over the content) than how to present the object of the research (content specification and knowledge structure) [5]. So constructing ontologies to form content and/or navigation system, improving navigation usability and level of knowledge acquisition is rather new and promising field. In recent years, there has been a growing interest in the development and use of domain ontologies, strongly motivated by the Semantic Web initiative [8].

In this paper we describe the experience of ontology developing for Knowledge Engineering courses based on the course for students of Saint-Petersburg State Polytechnic University. It seems important to describe goals we wanted to achieve while starting to develop the ontology. After that, OntolingeWiki, ontology-based tool for creating educational portals, is described. The paper concludes with summary and future work discussion.

2: Knowledge Engineering ontology

We’ve decided to make first a visual representation of the top level of ontology as a powerful mind tool in structuring process [4]. Visual form influences both analyzing and synthesizing procedures in ontology development process [6]. Also this is important as e-
learning systems require unambiguous and complete learning design [5]. The developed ontology will be also used as a table of contents for educational system.

The required qualities for the ontology to be used as a domain knowledge representation model are:

- Completeness
- Accuracy
- Cognitive adequacy [3]
- Conceptual balance [6]
- Excluding excessiveness and contradictions,
- Avoiding it being too complex and/or big.

The solution how to combine first and last demands is to make it more scalable – e.g. when user chooses the leave of top level ontology it proves to be the root of another one – the screen is not overloaded so the information is perceivable yet all the advantages of using ontology are kept.

3: OntolingueWiki – ontology-based technology for creating e-learning portals

This ontology is going to be presented and managed using OntolingueWiki which is a tool that takes advantage of both wiki-technology as a good environment for collaboration and ontologies as a tremendous tool for knowledge structuring. It can take any ontology saved in OWL format as an input and provide web-interface for ontology navigation with visualization based on hypergraph technology. Each concept of the ontology can be annotated with wiki-page created on demand (see http://ontowiki.org.ru:8180/ontolinge/dispatcher). OntolingueWiki was created on the base of Ontolinge-KAON system [2].

This technology can be used for creating ontology-based educational portals and was successfully leveraged in the design of the ontology-based content management system for the virtual exposition of the optical technologies museum in Saint-Petersburg State University of Information Technologies, Mechanics and Optics. Many electronic teaching materials such as presentations, animations or java-applets were united in the virtual exposition which introduces a visitor with optics according to the chosen ontology model.

4: Summary and future work

The main purpose of modern development of e-learning is to open up, share and reuse educational systems’ content and knowledge components. Ontology-based conceptual modeling makes concepts and theories more comprehensive for an individual by linking them with learning objects and technologically provides concrete and stable framework. Knowledge systematization also permits to boost quality [5].

We regard the developed ontology as a promising starting point towards achieving a fully functional adequate and up-to-date computer-based educational system where it’s going to be used as a domain knowledge representation model.

We consider OntolingueWiki tool a great step forward in creating a useful technological environment for creating ontology-based educational portals supporting collaboration.

5: References