CUBER: A Personalised Curriculum Builder

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Abstract

The fast development of technologies and vocational demands require specialised and complex skills that need to be renewed frequently. Therefore, the role of continuing education and lifelong learning is becoming still more important. The goal of the CUBER project was to develop a system that supports learners in searching higher education courses that match their specialised needs. A cornerstone of such a system is the metadata attached to courses and other relevant elements. However, the mere metadata itself is not very useful without the ontology that gives the semantics for the metadata. Basically, the ontology used in the system is the framework where we can match learners’ profiles (queries) against courses’ metadata (course profiles), thus providing a mechanism for ensuring that the learner finds relevant and interesting courses. In this paper, we present the CUBER system and the ontology developed for the CUBER metadata that is based on the Learning Object Metadata standard.

1. Introduction

Today people in all professions are faced with increasing demands. Technology has evolved in an ever-increasing speed, and the roles of people in work, society and industry are shifting constantly. Keeping up with the pace requires continuous education. Traditional universities are trying to answer to this need of lifelong learning by building virtual universities, whilst facing competition from the companies providing continuing education in the form of e-learning. [2]

CUBER is an international European joint effort project of many distance-teaching universities to provide information infrastructure for an e-learning system. One of the main results CUBER provides is the metadata for an e-learning portal. The name CUBER stands for Personalised Curriculum Builder in the Federated Virtual University of the Europe of Regions. The main focus of the CUBER project is to establish the groundwork for a Federated European Virtual University through a broker service (the CUBER system) that provides access to the vast array of courses particularly in information technology offered by European higher education providers, in particular universities providing possibilities in e-learning. CUBER is a research and development project funded by European Commission’s Fifth Framework Programme. [1]

We have started the ontology development process by recognising some essential ontology related requirements in higher education of information technology. It has turned out that when matching the educational supply to learners’ educational demand a very important aspect is that the level or the specificity of describing the supply (course profile) also has to match to the needs of the learner (user profile).

In the era of continuing education and diminishing borders, a virtual university becomes an extremely attractive idea. Here, by a virtual university, we mean a co-operation of several universities, which operates in the Internet as if it was a single university. There are various ways of interpreting the phrase ‘virtual university’. There is a university that does not actually exist, but is a service that the participating universities create together. [2]

There is a vast amount of courses and other educational possibilities available in a great number of universities all around the world. To be able to choose from all of these opportunities seems like the ideal situation for the future learner. In the CUBER project, research was done on a European virtual university. Among others, one main issue has been the lack of common ground for information exchange between the participating universities and countries. In this project, this problem has been addressed by the use of metadata and ontologies.

The information infrastructure for a virtual university is a system that has been built to integrate the information
services of the participating universities. This is acquired by a computer system that shows all the possibilities and available opportunities in all the universities as if they were in one big university. To transfer data seamlessly and transparently in the virtual university, there has to be a standard way of communicating all necessary knowledge, with both people and computer systems. The objective of our research was to enable this communication by providing a conceptual model and relevant ontologies for the purpose of building an information infrastructure for the virtual university.

2. The CUBER System

The CUBER system has been designed to be a search engine or a broker system that enables many kinds of students to search for study units from institutions providing higher education. CUBER aims at matching the needs of the learners with characteristics of the courses offered by the universities [1].

Technically, CUBER consists of three main components: a Knowledge Base for standardized course descriptions and domain knowledge, a Search Engine for finding the courses and generating study packages, and an Authoring Interface for entering and maintaining course metadata. The Knowledge Base includes a lexical database, where the standardized vocabularies and classifications are entered. The Knowledge Base also includes standardized metadata and an ontology, which defines the semantics of the metadata and the vocabularies used in the system. [3]

The basic elements of the CUBER system are learning objects, viz. programme, package, course and material. All these learning elements have metadata attached to them. All of these metadata fields and their corresponding data types were defined in a separate metadata specification. Some of the metadata fields require structure for the data input. This is done by using an ontology that provides the choice. Essentially, the ontologies give the semantics to the metadata. Consequently, the ontologies provide a shared and common understanding of CUBER’s metadata items, which is necessary for a fruitful communication between the learners and the CUBER system.

3. Metadata and Ontology

By metadata we mean descriptive and classifying information about an object. It describes certain important characteristics of its target in a compact form. Metadata plays a central role in improving searching and categorizing objects within a defined context of use. [4] In order to be able to use metadata efficiently across different contexts and systems, the metadata scheme must be standardised.

An ontology provides a general vocabulary of a certain domain, and it can be defined as “an explicit specification of a conceptualisation”[5]. In essence, an ontology gives the semantics to the metadata. The meanings of concepts have to be defined before the semantic web of the virtual university can be useful. [6].

4. Conclusions

As one of the results of the CUBER project a new and innovative metadata schema with an ontology was developed. This CUBER metadata and ontology is specially designed for the purposes of higher education offered by European universities and other educational entities. The CUBER metadata is based on the LOM standard of IEEE, but in order to meet the domain specific demands the LOM standard was extended after a thorough research in the field of higher education. In addition, a domain ontology for the metadata was created, documented and implemented.

Furthermore, the need for common semantics and vocabularies became evident during this multi-cultural research and development project. The concepts and vocabularies used in the different countries varied significantly, which gave rise to a need for defining an ontology for the metadata. The idea of using an ontology is to give semantics and a limited amount of possible interpretations for the vocabularies used. This is of utmost importance in order to avoid misinterpretations and misuse of the metadata. As a result an ontology with a conceptual model was defined for the CUBER metadata. This ontology not only defined the central concepts of the metadata but also presented the relations between the concepts. In general, ontologies provide a shared and common understanding of a domain. In this sense our used metadata model incorporates the ontology.

5. References