Methodological guidelines for the development of university course examination ontologies

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Abstract

Educational ontologies provide efficient software tools for knowledge representation in the case of e-learning systems, web-based education and intelligent tutoring systems. Starting from EduOntoFrame, a framework for the design of a general educational ontology for university didactical activities (teaching, learning, examination), the paper proposes a set of methodological guidelines for university course examination ontology development. Under the EduOntoFrame framework, a general university course ontology is composed by university teaching ontologies, university learning ontologies and university examination ontologies. In the case of a university course examination ontology, the university course teaching ontologies are the basic resources for the development of the knowledge base with questions, problems, exercises and answers. Also, such an ontology will include some course examination terms, which are course-independent. An example of using the proposed guidelines for a university course examination ontology development is presented.

Keywords: Educational ontologies, Methodology, University course examination

1 Introduction

University educational ontologies include concepts and terms specific to all three phases of any university course didactical activity: teaching, learning and examination. They provide efficient software tools for university course knowledge representation and sharing between teachers and students, under e-learning systems, web-based education systems and intelligent tutoring systems. Most of the educational ontologies reported in the literature use particular methodologies or frameworks for their development. Some examples are given (Alert et al., 2006; Doan and Bourda, 2006; Boyce and Pahl, 2007; Grigore et al., 2013). We have proposed in (Oprea, 2013) a general framework, EduOntoFrame, for educational ontologies development. Starting from this general framework we have designed a methodology sketch for university course examination ontology development in a similar way with the methodology sketch proposed for university course teaching ontology development that was introduced in (Oprea, 2014). The university course examination ontology and the university course teaching ontology are interrelated due to the use of the teaching ontology in the course examination ontology. Thus, the course examination ontology is based on the course teaching ontology as a mandatory request.

The paper is organized as follows. A set of methodological guidelines for university course examination ontology development is introduced in the next section. After that, an example of course examination ontology for the course of Computer Programming Languages, generated with the proposed guidelines set, is presented. The final section concludes the paper.

2 Methodological guidelines for university course examination ontology development

The general view of the course examination activity is shown in Figure 1. During the examination activity, the student will have to solve certain problems, tests, exercises or other...
forms of course examination either offline or online (e.g. computer-based examination with a certain time deadline constraint or in a traditional form of course examination as is student-teacher face to face interaction). The course examination ontology can be developed starting from the *EduOntoFrame* general framework proposed in (Oprea, 2014). The framework generates eight ontologies: course teaching ontologies (four ontologies), course learning ontologies (two ontologies) and course examination ontologies (two ontologies).

The two course examination ontologies (Course Examination Ontology – CE and Course Basic Examination Ontology – CBE) are shown in Figure 2. The CBE Ontology is a course independent ontology and includes concepts and terms specific to any university course examination activity.

Figure 1. A general view of the university course examination activity

Figure 2. The university course examination ontologies generated by the *EduOntoFrame* general framework
The course examination ontology (ExamOnto = {CBE, CE}) is generated by using the following methodological guidelines set.

Methodological Guidelines Set

**Input:** Course, Course Teaching Ontology (TeachOnto);

**Output:** ExamOnto

1. identify or take (from existing educational ontologies) the basic concepts of any university course examination activity;
2. ExamOnto ← basic university course examination concepts;
3. link to ExamOnto the corresponding university course teaching ontology (TeachOnto);
4. identify the specific course examination concepts (basic and advanced) from TeachOnto;
5. add to ExamOnto the specific course examination concepts (basic and advanced);
6. return ExamOnto;

Figure 3 shows the structure of the university course examination ontology. Examples of terms included in the ExamOnto ontology are:

- examination method, examination feedback, assessment, self-assessment, exercises, individualized exercises, questions, tests, problems, simple problems, complex problems, theoretical problems, research experiments, written and oral examination, computer-assisted examination, student synthesis capacity, student analysis capacity, mark, student level etc.

![Figure 3. The structure of the university course examination ontology (ExamOnto)](image)

3 Example of university course examination ontology

We have applied the methodological guidelines for the development of a university course examination ontology in the domain of Computer Science, for Computer Programming subdomain.

The course examination ontology named ProgramExamOnto was developed for the course of Computer Programming Languages by following the guidelines given in the previous section. We have considered that the following computer programming languages were taught to the undergraduate students: Pascal, C and C++. A prototyped ontology was implemented in Protégé 4.1, a Java-based ontology editor. Figure 4 presents a screenshot with some classes of this prototype ontology, which can be extended with more concepts.
Figure 4. A screenshot with some classes of the university course examination ontology, ProgramExamOnto, in Protégé 4.1 (OntoGraph)

Examples of Computer Programming Languages course specific concepts are: control instruction, if instruction, while instruction, for instruction, simple problem, complex problem, sorting problem, search problem.

The course examination ontology can be used by teachers and students for university course examinations performed through various computer or network-based educational systems such as web-based systems, collaborative networks or e-learning platforms.

4 Conclusion

The paper proposed a set of methodological guidelines for the development of a university course examination ontology, ExamOnto, based on the EduOntoFrame educational ontology development framework. An example of such ontology for the domain of Computer Programming Languages was presented.

References


