

# Chapter 3

## Educational Ontology Development

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### **ABSTRACT**

*Ontology use in education environments can be explained in three groups: content access and/or retrieval, content creation, and personalization. Use of ontologies helps content creators to design and develop online courses, provide smart searches and content suggestions, and design personalized learning environments for learners. But it is not always possible for educators to find the best ontology for their needs in their learning management system. Since the ontology creation is a complex process, it might not be always easy or even possible to create an ontology for a selected domain and use accordingly. In this chapter, a review of state-of-the art literature regarding the ontologies in educational domain will be reviewed. Second, the challenges and difficulties in ontology development process for educational domain will be addressed and explained in detail. Finally, design suggestions to the difficulties expressed in the literature and further opportunities in ontology design and development will be presented, taking the existing ontology evaluation frameworks into account.*

### **INTRODUCTION**

Amount of data on the web is constantly growing day by day and it is a new skill to be developed for users to reach the information for their needs, tasks and/or goals among vast amount of information. Likewise, in educational domain, it is a big challenge for teachers and learners to find educational resources on the web and to be sure that these resources meet their requirements. Semantic web technologies, including ontology use, offer a solution for those problems to be solved within educational domain by using domain ontologies.

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## **Educational Ontology Development**

Ontology provides a framework to determine a domain of interest and to build a common understanding in this domain between different applications by representing concepts and relationships that exist between these concepts. Ontology use in education environments can be explained in three main groups: content access and/or retrieval, content creation, and personalization. Use of ontologies also helps content creators to design and develop online courses; provide smart searches and content suggestions; and, design personalized learning environments for learners. All these advantages come with a price, though: It is not always possible for educators to find the best ontology for their needs in their Learning Management System (LMS). Consequently, users generally have to create their own ontologies from scratch.

In developing an ontology, there is no single and/or standard method to follow that can be applied to all domains since they are widely differ across domains as in law, medicine, information technologies, education, military etc. Since the ontology creation is a complex process, it might not be always easy or even possible to create an ontology for a selected domain and use it across domains.

To address these concerns, in this paper, first, a review of state-of-the art literature regarding the ontologies in educational domain will be reviewed. Second, the challenges and difficulties in ontology development process for educational domain will be addressed and explained in detail. Finally, design suggestions to the difficulties expressed in the literature and further opportunities in ontology design and development will be presented taking the existing ontology evaluation frameworks into account.

## **BACKGROUND**

### **Approaches to Ontology Development for Educational Purposes**

There are several classification methodologies when developing ontologies in education, among which are domain-task, task, and domain ontologies (Breuker, 1999; Devedzic, 2004; Allert et al., 2006; Al-Yahya et al., 2014). Based on their purposes, we can categorize educational ontologies in three groups:

- Ontologies for content access (Aroyo et al., 2002; Mitrovic & Devedzic, 2004; Lemnitzer et al., 2008; Lama et al., 2012; Solomou et al., 2015),
- Ontologies for content creation (Simon et al., 2004; Neto & Gauthier, 2006; Boyce & Pahl, 2007; Oprea, 2011; Manganello et al., 2013; Çelik et al., 2014),
- Ontologies for personalization (Henze et al., 2004; Karampiperis & Sampson, 2005; Fok, 2006; Vargas-Vera & Lytras, 2008; Chen et al., 2011; Clemente et al., 2011).

In the following section, each of these groups will briefly be described.

### **Ontologies for Content Access**

Content access is usually related to providing an access to the existing content within the curriculum in a domain. The main assumption is to list all the standards/goals in a specific course curriculum and map the ontology to these standards accordingly. In their ontology development, for example, Al-Yahya et al. (2014) have designed a curriculum ontology named CURONTO. In their research, they used CURONTO to manage and assess the existing curriculum to provide feedback to the teaching program. They also claimed that, their ontology model is used to establish relations between goals, learning process and the

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