Research and Conceptualization of Ontologies in Intelligent Learning Systems

Boryana Deliyska, University of Forestry, Bulgaria

Peter Manoilov, Technical University, Bulgaria

ABSTRACT

The intelligent learning systems provide direct customized instruction to the learners without the intervention of human tutors on the basis of Semantic Web resources. Principal roles play ontologies as instruments for modeling learning processes, learners, learning disciplines and resources. This paper examines the variety, relationships, and conceptualizations of ontologies used in intelligent learning systems. The domain and application ontologies assist in the building of learning content (courseware) and in the process of knowledge acquisition (learning session). In this paper, the conceptualization of the domain ontologies is presented by the upper levels of its taxonomies, a method and an algorithm intended for the generation of application ontologies of structural learning objects, that is, curriculum, syllabus, and lesson plan, are developed. Examples of curriculum and syllabus application ontologies are given.

Keywords: *E-Learning, Intelligent Learning System, Learning Agent, Learning Object, Ontology-Based Learning, Taxonomy, Web-Based Learning*

INTRODUCTION

An intelligent learning system (ILS) is a distributed system for e-learning whose modules can be independent and located in different nodes (servers) on the Web. This kind of e-learning is achieved through the resources of the Semantic Web and is designed and developed around a course, group of courses or specialty. By Stojanovic, Staab, and Studer (2001, p. 1177):

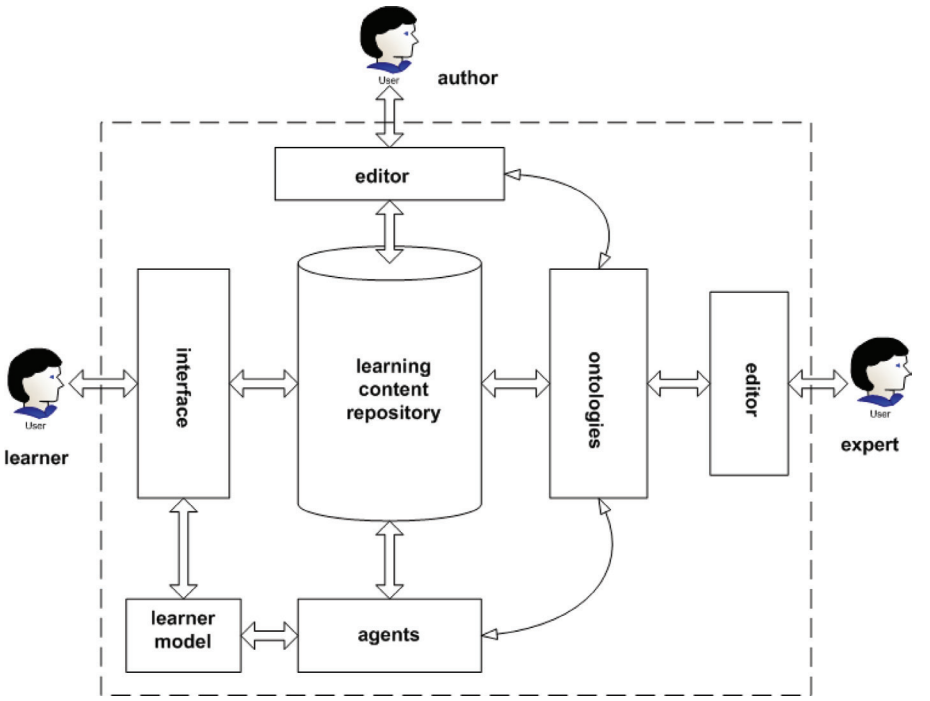
In fact, the Semantic Web could be treated as a very suitable platform for the implementation of an e-learning system, because it provides all resources for (e-learning) ontology development, ontology-based annotation of learning materials, their composition in learning courses and the (pro)active delivery of the learning materials through e-learning portals.

A general schema of ILS is given in Figure 1. This schema illustrates the modules and the participants in ILS activities.

The expert builds and supports ontologies necessary for e-learning activities by an application named *ontology editor*. The author creates and supports learning content (courseware) through an *authoring system editor* tool

DOI: 10.4018/jdet.2010100102

Figure 1. General schema of intelligent learning system



and using ontologies. One might say that "the courseware is constructed by the author simply by identifying the sequence of learning objects references which participate in the courseware" (Atif, Benlamri, & Berri, 2003, p. 65). The annotated by metadata and reusable *learning objects*[1] (LO) are archived in a *learning content repository*.

Software agents play different roles: Pedagogical agent (facilitator or course instructor) helping learning process; Content agent supplying learning objects to the learner; Input agent checking learner account and actual learner status in the beginning of each learning session, and; Valuation agent calculating test score and registering it in the *learner model database*.

The learner model defines the personalization (individualization) and the adaptability of the e-learning in an online learner-centered environment. The learner receives LO by its own interface (e-learning portal) but could also browse some entry level content materials (course syllabus, LO examples etc.) directly from the learning content repository.

Within ILS the ontologies are used at two main stages – at the time of courseware building and in the process of knowledge acquisition (learning session).

The goal of this work is to define the kind of ontologies used in ILS and to study its conceptualization.

In this paper firstly we formulate and examine ILS ontologies and their relationships. Further the conceptualization schemas of the upper levels of the domain ontologies in e-learning are given. In the next section method and algorithm of conceptualization of application LO ontologies are drawn. In the end conclusions and future work considerations are discussed.