Course composition and pedagogical resources representation with ontology

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Abstract

E-Learning systems or online learning are currently available on the Web various types of learning resources. E-Learning refers to the use of computer technologies to design, create, deliver, manage and support learning for students and help teachers to provide their resources on the internet. The purpose of this paper is try to define and represent learning resources based on ontology and course sections. We describe and categorize learning resources by using Learning Objects Metadata Standard (LOM) and define attributes that can be possible in learning resources. For the ontology, we define relations between concepts and sub-concepts more specifically into two dimensions of relation's view. We propose the course representation with sections and concepts model which can represent the relation between learning objects, concepts in ontologies and sections.

Key-Words: E-Learning, ontology, metadata, data representation

1. Introduction

Various types of learning resources are currently available on the web with the increasing of e-learning usage. E-learning technology helps teachers to provide their courses and learning material to students. Nowadays, students can search and browse through many course's web sites over WWW technology. Many researches are trying to produce courses on user demand from the same body of teaching material. Course generation and learning material storage is interesting.

Our research is how to represent the several types of resources which are composing by course? How to define and represent the order of sequence of these resources? And how to represent several types of links between resources? In the step forward, we will try to represent with Ontology-based.

2. Element of pedagogical resources and course composition.

There are various name of pedagogical resource, e.g. learning object, learning material, teaching material, and instructional object. In [1], he defines pedagogical resource as a learning resource that serves a particular pedagogical role. These roles are reflected in the classes of ontology. Examples of several types of instructional objects are concepts, example of applications of the concept and activities to apply the concept.

Normally in each course, there is the curriculum which can be a guideline and overview of the course. Curriculum is composed of many chapters, sub-chapters. If we call each smallest unit of the resources in the curriculum as section, each section can be related with more than one learning object and it is also possible that two sections are related to the same learning object.

Each course is also composed of many concepts which are the goal of learning for the students. Concept is an abstract term describing some sub-topic found in the learning domain [7]. We are trying to define and represent these learning objects with respect in the relation between section and concept.

3. Metadata and learning objects specification

In this work, we define how to store and represent learning resources in course with respect in many category functions of learning objects. The representation can be useful for teacher or author to provide their course efficiency to student by cover all contents and concepts to reach the goal of learning. The use of metadata is needed for the efficiency of information searching system for the student.

Metadata is data about data that helps us to achieve better search results [2]. The educational metadata provide descriptions and additional information about learning resources (e.g. multimedia contents, electronic books, software application, etc.). This

information can be used not only for characterizing the resources but also for searching, cataloguing and improvement [3]. One of the most common metadata schemes on the Web today is the "Dublin Core Schema" (DC) by DCMI, The Dublin Core Metadata Initiative [The Dublin Core Metadata Initiative, 2004]. Each Dublin Core element is defined using a set of 15 attributes from the ISO/IEC11179 standard for the description of data elements. The "Learning Objects Metadata Standard" (LOM) [4] by the Learning Technology Standards Committee (LTSC) of the IEEE was therefore established as an extension of Dublin Core. Each learning object can now described using a set of more than 70 attributes divided into 9 categories.

Learning Objects are any digital resource that can be reused to support learning [7]. We describe Learning object is a smallest unit of learning materials of the course for example, a file of text document file.

We categorize the several types of learning objects by many category functions from LOM [4].

3.1 Categorize resources by type of pedagogical

For example; resource (material type), bibliography, course outline, correction of exercise/examination, exercise, examination, FAQ, lecture notes and reading

3.2 Categorize resources by format type or media type

For example; slide, video, audio and text/narrative text .doc (document file), .html (hypertext markup language file), .ppt (PowerPoint presentation file), .ps (post script file) and .pdf (Portable Document Format)

3.3 Categorize resources by concept

According to the field of knowledge or knowledge domain, this can mean the ontology of the course. For example, concepts in database course are Database structure, Query processing, Control and Management, Designing and File organization.

4. Ontology representation

In [5], they present the management of the knowledge which is made on three levels and they are interconnected: learning objects, metadata and ontologies. The main relations which arise in ontologies of learning objects are the following ones:

Be_a_part_of(x,y,i) means that x is a part of y. Thus, it is necessary to know the resource x if the student wants to study the resource y.

The value i represents the validity index of the relation (i.e., Reliable indication of the relation). In fact, it is a weight. This value has the same signification in the three following relations.

Be_explained_by(x,y,i) means that the resource x can be explained by the resource y.

Be_required(x,y,i) means that the resource x needs the resources y as prerequired.

Be_suggested(x,y,i) means that it is better to know the resource y before making the learning of the resource x. If student is interested in the resource x student can use it independently of the resource y. Student doesn't have to know both resources.

The reference supplied by the authors must be used to create semantic links between two resources.

These relations can be arise among two concepts which are in the same or different levels of ontology

For example, in figure 1 there are two sub-concepts in concept Query processing; Relational algebra and SQL queries. They mean sub-concept Relational algebra and sub-concept SQL queries are parts of concept Query processing. Thus, each relation is Be_a_part_of. Between these two sub-concepts, if the teacher suggests to study Relational algebra before SQL queries. Thus, relation between sub-concept Relational algebra and sub-concept SQL queries should be Be_ suggested. As shown in figure 1.

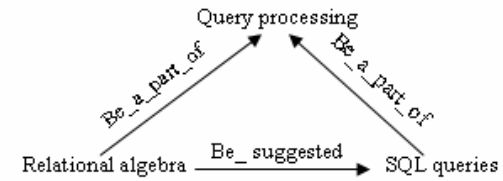

Figure 1. An example of relations between concept and sub-concepts in ontology

4. Scenario of course representation

The section and concept of the course can be reused. These two elements are self-related while the analogy is similarly to prerequisite.

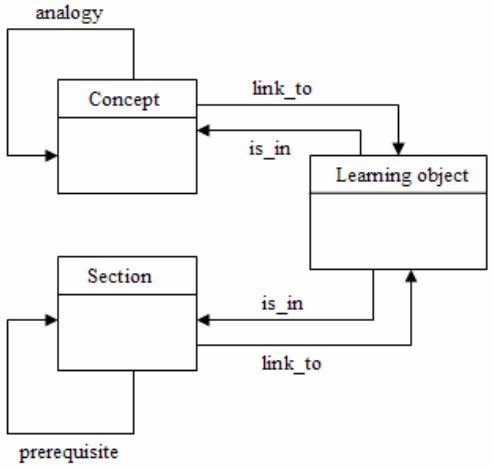

Figure 2. The basic of course annotation.

The basic of course annotation can be shown in figure 2. Link relation between concept and learning object can be defined in two: link_to and is_in, mean concept is link to one or more learning object(s) and one learning object is in one or many concept(s) and the same with links between section and learning object.

We propose the scenario and steps of course representation. Figure 3 is an example of scenario of course representation.

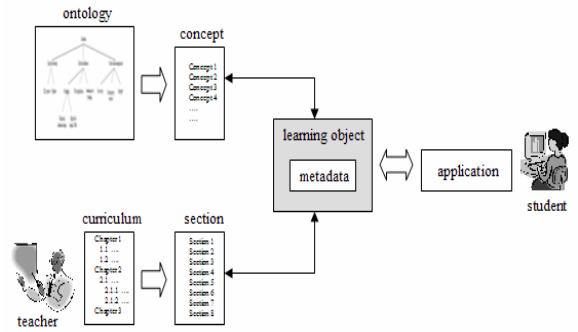

Figure 3. The scenario of course representation.

Teacher collects or creates learning resources for his/her course in any types of format and store there resources describing by metadata. Each domain of learning is formed in tree, all concepts in the domain are stored and described by metadata with link to concerning learning object. When teacher have a course, teacher will create curriculum that divided into sections and sub-sections and specific link to concerning learning objects.

5. Conclusion and future work

This article proposes the pedagogical resource, categorization of several types of learning objects by many category functions from LOM. We describe the representation of ontology and the course representation with sections and concepts model which can represent the relation between learning object, concept in ontology and section in course. For future implementation, perhaps it is possible to use structured information documents markup language like XML or a stands for Resource Description Framework (RDF).

6. References

[1] C. Ullrich, Description of an Instructional Ontology and its Application in Web Services for Education. Proceedings of Workshop on Applications of Semantic Web Technologies for E-learning, SW-EL'04, pages 17-23, Hiroshima, Japan, November 2004.

[2] J.Brase, W.Nejdl "Ontologies and Metadata for eLearning" in Handbook on Ontologies, (Springer-Verlag 2003)

[3] J.Santos, L.Anido and M.Llamas, "On the Application of the semantic Web Concepts to Adaptive E-learning", The 3rd IEEE International Conference on Advance of Learning Technologies (ICALT'03), July 09-11, pp. 480-489, 2003.

[4] Learning Technology Standards Committee of the IEEE: Draft Standard for Learning Objects Metadata IEEE P1484.12.1/D6.412., June 2002)

[5] P.Wood. "Organization and storage of metadata, annotations and ontology", Workshop organized by the action "Semantic Web and E-learning" of Kaleidoscope NoE, Paris, May 3-4, 2004.

[6] The Dublin Core Metadata Initiative, http://dublincore.org/

[7] V.Kolovski, S.Jordanov and J. Galletly. "An Electronic Learning Assistant", International Conference on Computer Systems and Technologies, 2004.