PEDAGOGICAL RESOURCES REPRESENTATION IN RESPECT IN ONTOLOGY AND COURSE SECTION

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Abstract: E-Learning or online 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. And each web site contains sets of pages and associated indexes. To organize learning resources to facilitate the access to these resources by teachers or students, many useful queries and computations over such repositories involve traversal and navigation of the Web graph. In this paper we purposed learning resources cauterization by applying S-Node graph with respect in ontology or concept structure.

1 INTRODUCTION

E-Learning or online 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. For teachers to prepare their courses, searching and collecting learning resources will be necessary in the primary step. Material resources come from variety sources, e.g. website, text book, and in different kind of format, e.g. text, slide, video, audio, etc.

Imagine in database scope, there are many courses that concerned with database in many levels, for example: introduction to database, database system principles, advanced topics in database systems, and database system implementation. Each courses are different in difficulty level but they are shared the same basic concept. For teachers who prepare these database courses, it is possible that they will use or refer to the same materials. A question is what is the effective way to store and manage these materials or pedagogical resources for sharing and reusing?

In our work, we are trying to define the approach between *Concepts*, *Learning objects* and *Chapters*. In figure 1, there are three learning objects which are compositions of chapters. It is possible that a learning object is used to be taught in one or more chapters. And each learning object talks about a concept, these concepts are represented as domain ontology. We defined a course is a set of chapters which are arranged in sequence called curriculum. Normally, when teacher sets up a course, curriculum of course is a guide line or overview for the course. In our system, curriculum is builded by teacher or lectures of that course and links between each chapter indicate sequence or prerequisite of course.

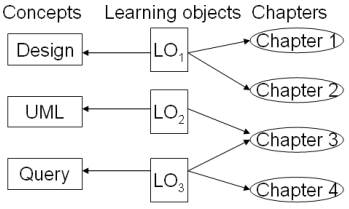

Figure 1: Compositions of course.

As we aim that in this research, we try to define relation and representation among three compositions; *Learning objects*, *Curriculum* and *Ontology*. In the next section, we describe about the each compositions and their relations.

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2 LEARNING OBJECTS

2.1 Definitions

The first definition is stated by the Learning Technology Standards Committee at the consortium IEEE (IEEE, 2002) defined that learning objects are defined here as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. In (Ogbuji, 2006) described [A Learning Object is] any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning.

In this work, we define learning object is a smallest unit of learning material that can share or re-use between each course. For example, *course A* has learning material named *slide1*. And in *course B*, there is relation that concerning with some part of *slide1*, so the author wants to use only some concerning part in *slide1* in *course B*. In this example, we will separate *slide1* into two parts; *slide1-1* and *slide 1-2* (suppose that *slide 1-2* is a part that concern with *course B*). Thus, we will have two learning object; *slide1-1* and *slide 1-2* (not only *slide1*) as shown in figure 2.

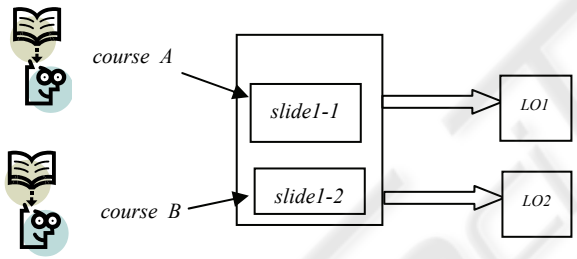

Figure 2: Courses and learning objects.

2.2 Metadata for Learning Resources

Metadata is data about data that helps us to achieve better search results (Brase & Nejdl, 2003). 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 (Santos et al., 2003). One of the most common metadata schemes on the Web today is the "Dublin Core Schema" (DC) by DCMI, The Dublin Core Metadata Initiative 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) (Learning Technology Standards Committee of the IEEE, 2002) 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 (Kolovski et al., 2004).

Learning resources or pedagogical resources can be described in many aspects. For example, the "Learning Objects Metadata Standard" (LOM) (Learning Technology Standards Committee of the IEEE 2002) by the Learning Technology Standards Committee (LTSC) of the IEEE describes learning resource by metadata. In (Bich-Lien et al., 2004) uses OWL to describe metadata of learning resources and mentioned some definition from IEEE LOM to preserve the semantic given by it.

3 CURRICULUM

A course consists of curriculum or outline which is the overview instruction of course that is organized by teacher, lecturer or author of the course. This curriculum or outline is course structure that normally is separated into small unit called chapters or section, and each unit can be separated into sub-unit called sub-chapter or sub-section (see figure 3).

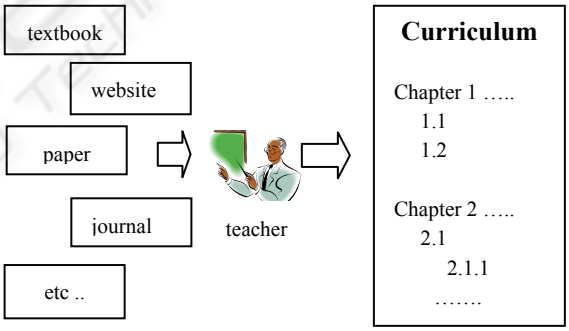

Figure 3: Curriculum or course structure.

Course materials or learning materials can be possible come from many resources, e.g. textbook, journal, paper, website, etc. And various formats, e.g. text, video, slide, audio, etc. In curriculum, units and sub-units can be ordered and grouped by context or difficulty of material under consideration of the author of course.

4 REPRESENTATION OF COMPOSITIONS OF COURSE

In section 1, we introduced the problems of course representation with three compositions; *Learning objects*, *Curriculum* and *Ontology* that we described in section 2, 3 and 4. Between learning objects and ontology, we represent this relation with learning resource management with ontology model and S-node algorithm to represent relation between learning objects and curriculum of course (see figure 4).

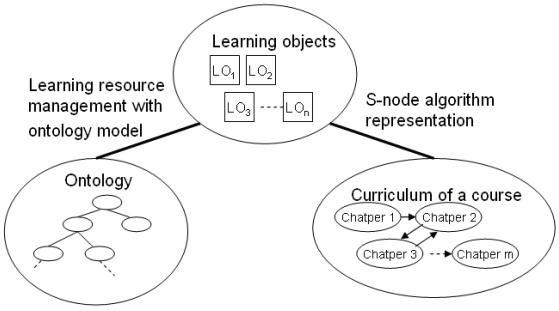

Figure 4: Three compositions of course.

4.1 Learning Resource Management with Ontology Model

In our work, ontology is concept that describes the central pieces of knowledge, the main pieces of information being taught in a course. Subclass of concepts are fact, definition, and different kinds of laws and process (Merceron et al., 2004).

In figure 5 (Bastide et al., 2004) defined the management of the knowledge is made on three levels which are interconnected. The first level: learning objects. It is the lowest level of the data model. It concerns the storage of the learning objects without metadata.

The second level: metadata. This level contains the descriptions of the learning objects. The metadata generally follow a schema which is defined by standards such as IEEE LOM or SCORM.

The third level: ontologies. This level contains the representation of the concepts, the sub-concepts and the links. This part allows one to organize and to manage components contained in the previous two levels. The instances of the ontology model contain the metadata (Level 2) which are used to describe the learning objects (Level 1). The learning objects (Level 1) are described by metadata (Level 2) and regrouped by ontologies (Level 3).

The main relations which arise in ontologies of learning objects are the following ones: First, the relation *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 we want 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.

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

Third, the relation *Be_required(x,y,i)* means that the resource x needs the resource y as pre-required.

And the last one, the relation *Be_suggested(x,y,i)* means that it is better to know the resource *y* before making the learning of the resource *x*. If you are interested in the resource *x* you can use it independently of the resource *y*. You do not have to know both resources.

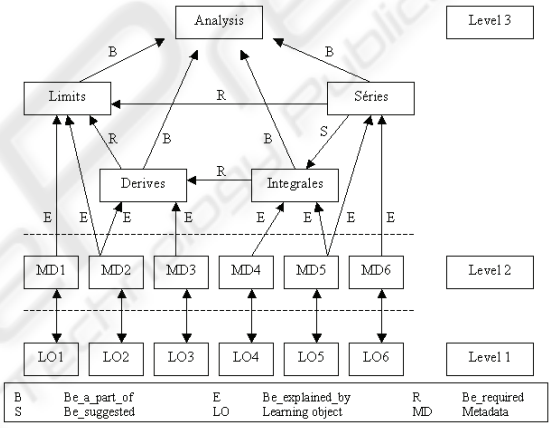

Figure 5: Example of an ontology model for mathematics.

The references supplied by the authors must be used to create semantic links between two resources. If a link doesn't exist between these two resources, a relation of type *"Be_suggested"* will be created.

4.2 S-node Graph

S-node representation is a representation for Web graphs proposed by (Raghavan & Garcia Molina, 2003). It provides two key advantages: First S-Node representations are highly space-efficient. Such significant compression allows large Web graphs to be completely loaded into reasonable amounts of main memory, speeding up complex graph computations and mining tasks that require global/bulk access. Second, the top level graph serves the role of an index, allowing the relevant lower-level graphs to be quickly located. S-node representations reduce query execution time.

4.2.1 Structure of an S-Node Representation

S-Node representation divides nodes of graphs into classed, each class of nodes is called supernode. Two-level S-Node representation of the Web graph as shown in Figure 6.

Supernode graph contains n vertices (call supernodes), one for each element of the partition. Supernodes are linked to each other using directed edges (called superedges). Superedges are created based on the following rule: There is a directed superedge $E_{i,j}$ from N_i to N_j if there is at least one page in N_i that points to some page in N_j.

Each partition is associated with an intranode graph. $IntraNode_i$ represents all the interconnection between the pages that belong to N_i.

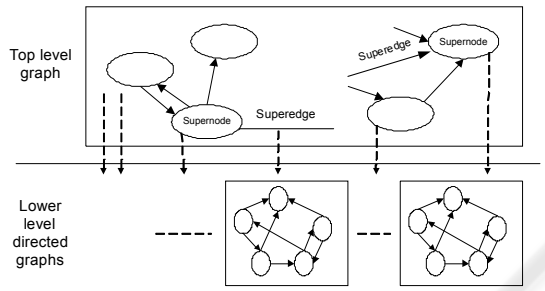

Figure 6: S-Node representation of a Web graph.

4.2.2 Apply S-node Graph with Learning Objects Indexing and Categorizing

To represent relation between learning objects and curriculum of a course by using S-node algorithm, we define each learning object as a node in lower level while chapters are super nodes in top level. In figure 7, for clustering learning resources, we follow S-node algorithm. This approach will be done automatically and dynamically by the system.

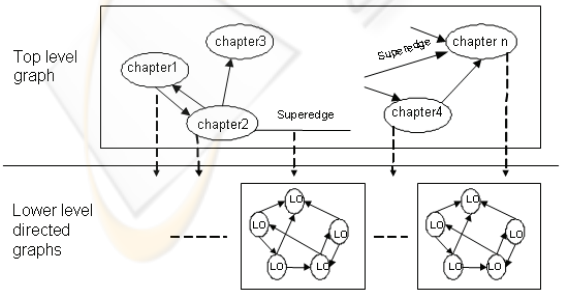

Figure 7: Learning objects represented with S-node graph.

5 CONCLUSIONS

Our work is addressed the problem of efficiently way to share learning materials or pedagogical resources and how to representation courses with several types of resources. We apply S-node graph, which provides highly space-efficient and reduce query execution time, and ontology model. This work is in progress and we plan to extend the model and hope to realize some experiments.

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