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Learning object specification and description of pedagogical resources in respect to material structure and content

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Abstract: Nowadays, many E-Learning systems are currently available on the Web with various types of learning resources. Website becomes one of important communication lines between teacher and student. For teachers to prepare their courses, searching and collecting learning resources will be necessary in the primary step. 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. The question is what is the effective way to share their materials or pedagogical resources? And for their own courses, how to representation these courses with several types of resources?

1. Composition of a course

Each course consists of many pedagogical resources or learning resources with various types of them. A course unit is based on Knowledge and competencies it should provide, on actor (learners, instructors, trainers, course designer, administrators, etc.) and on resources of different types (definitions, exercise with or without solution, case studies, etc.), and different forms (reports, books, web sites, etc.). In these sense, a course is an organization (Abel et al. 2004).

In (Ullrich 2003) shows that a course consists of: 1.) Structures sequence of learning materials. 2.) Instructional goal of a step. 3.) Time constrains. 4.) Reaction when time constrains are violated or goal are met. All these composition will lead to learning strategy, personalization and how to generate learning materials that are best suited for an individual learner and his tasks.

In this work, we define a course with four compositions: curriculum, learning object, metadata and domain structure and semantic relations.

1.1 Curriculum

A course consists of curriculum or outline which are the overview instruction of course. Curriculum is organized by teacher, lecturer or author and it is separated into chapters and sub-chapters. Course materials or learning materials can be possible come from many resources and various formats. In curriculum, chapters and sub-chapters can be ordered and grouped by context or difficulty of material under consideration of the author of course.

1.2 Learning object

Learning objects are sometimes defined as being educational resources that can be employed in technology-supported learning. With appropriate metadata descriptions, they can be modular units that can be assembled together to form lessons and courses. A LO can be based on an electronic text, a simulation, a Web site, a .gif graphic image, a Quicktime movie, a Java applet or any other resource that can be used in learning (McGreal 2004). In (Brusilovsky & Vassileva 2003), teaching materials contain presentation and testing-units that carry out the communication with student and for Dynamic Courseware Generator by (Vassileva 1997), the teaching materials are html-files which can be distributed on different sites in the WWW.

1.3 Metadata

Metadata is data about data that helps us to achieve better search results (Brase & Nejd1 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 (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) (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).

In (McGreal 2004), Metadata includes a listing of commonly defined fields for each LO. These fields conform to an accepted set of rules. These rules provide a means of creating, handling and storing data and electronically transferring information using common standards that enable international interoperability. Institutions normally insist on a subset of mandatory fields. These are often accompanied by a larger listing of optional fields. Additional fields can normally be added, so that the specifications are generally extensible.

1.4 Domain structure and semantic relations

In (Brusilovsky & Vassileva 2003), the domain structure contains the concepts/topic structure of the subject knowledge to be taught. It is represented as AND/OR graph while the node represent the elements of knowledge (concepts, topics, rules, etc.).The arcs in the graph represent relationship between the concepts. These relationships can have various semantics, for example: aggregation, generalization, casual, temporal, analogy and simple prerequisite. It is possible to organizes the domain concepts/topics into a smaller, possibly interrelated AND/OR-graphs, representing relatively independent sub-areas of the domain, different ‘views’, or different levels of granularity. Every node and every link from the Domain structure is associated with a set of teaching materials (TMs), which instantiate different ways to teach the concept/topic (e.g. introduce, explain, given an example, exercise, or test). The domain structure is used for creating a plan of the course contents (a sub-graph of Domain Structure) to achieve a given teaching goal (concept).

In IMS, an author specifies the structure (e.g., sections and subsections) of a collection of learning materials and additionally provides information on how to guide the learner through this structure (Ullrich 2003). In our work, we describe domain structure is an ontology.

2. The specificities of learning objects

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

2.1 Categorize resources by type of pedagogical resource (material type)

- Lecture notes
- Exercise
- Examination
- Course outline
- Reading
- Correction of exercise/examination
- FAQ
- Bibliography

2.2 Categorize resources by format type or media type

- Categorize by format type
 - .doc (document file)
 - .html (hypertext markup language file)
 - .ppt (PowerPoint presentation file)
 - .ps (post script file)

- .pdf (Adobe Portable Document Format)
- Categorize by media type
 - Slide
 - Video
 - Audio
 - Text / Narrative Text

2.3 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. In the next section we use this categorization to represent learning objects.

3. Description of the resources

Learning resources can be described by 2 respects; by structure and by the context of the resource.

3.1 Description of the resources by structure

In this work, we mean structure in author's material view. The author of the course can take learning materials of his course from many sources which have differently content grouped. Some materials are grouped and consist of many topics, and they are different in different material's author. In this case, we describe learning resource following by the content that the author's material gives.

3.2 Description of the resources by the content of the resource

The content of resource means the content that learning material is talking about. It is possible that many topics can be composed in a learning resource. This is concern with the ontology.

From section 1.4, the ontology provides a vocabulary that captures the "instructional semantics" of a virtual or text-book learning resource. In general, each learning object serves a particular pedagogical role. These roles are reflected in class of the ontology (Ullrich 2004).

4. Conclusion and future work.

We describe learning resources by two respects. We try to represent learning resources with can involved these description. For example, if the author of the course wants to take only some chapters or sub-chapters in each book so he will describe his resources by structure. And if this author also wants to make relations to learning material in slide form, but he want to link to only some slides that concerned with his course. In this case, learning resource should be described by content of the resource. We wished to create the learning representation model on the educational materials context in taking in account of these respects: structure and content of the resource. This work is in progress and we hope to realize some experiments.

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