# Ontology-based Access to the Resources of a Course Memory

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**Abstract**. Many documents and resources can be provided to students in the context of distance learning. It is however often difficult to identify pertinent resources and to organise them in coherent sets. A first direction to address this problem is to build resources banks or learning objects repositories. Re-using these resources for a specific course unit often needs an instructional design work. In the Memorae project, we study another direction, which consists in building a course memory or more generally a "learning organisational memory", that can be directly used by students. In this paper, we describe the content of this memory, the ontologies on which it relies, and the navigation possibilities it offers. We show how this memory can be used to support self-regulated learning.

## 1. Introduction

The development of distance learning reduces contacts between learners and teachers and leads learners to be more autonomous and more active in their learning process. In the same time, they can have access to more and more documents and resources either produced in the context of the course they are involved in, or directly available on the web. It is however often difficult for learners and even for distance learning designers to identify pertinent resources and to organise them in coherent sets. In order to address this problem, projects aiming at building pedagogical resources banks and learning objects repositories have been launched.

Usually, these repositories do not deliver ready-to-use material. An instructional design work is often needed. They are therefore designated rather for instructional designers or teachers in order to allow them to help them to build adapted courses or training. In the framework of the MEMORAe[1] project [1], we propose on the contrary to give the students a direct access to the learning resources. This suppose to do earlier a part of the instructional design work, by selecting pertinent resources, organising them and giving students means to self-regulate their learning process [2].

In this paper, first we present the classic approach of resources banks and learning objects repositories, then we describe the main characteristics and contents of the learning organisational memory we designed in the MEMORAe project. Finally, we present a pilot application that we developed for an applied mathematics course at the university of Picardy.

[1] MEMORAe stands for ORganisational MEMory Applied to e-Learning. This project is supported by the region of Picardie (France)

## 2. The Memorae Approach

Since a few years, many projects aiming at building bases of learning resources, in order to share and re-use them, have been launched. There are two kinds of resources bases : learning object repositories that group many subject matters (for example Merlot [3] or Ariadne[4]) and thematic resources bases [6]. In both cases the resources are not ready to be used by learners. An instructional design work is usually needed before.

On the contrary, within the MEMORAe project, our goal is to let learners directly access the resources of a course memory. Following a knowledge engineering approach, we organise the resources in an organisational memory. Actually, it is a course memory, in which a course is seen as an organisation (see section 3). A course memory is different from a learning memory [5] because its goal is not to help learners to remember what they previously studied. It can rather be seen as a memory of concepts and resources that teachers or designers find useful in the framework of a particular course.

In order to give learners a direct access to the memory, a part of the instructional design work has to be made earlier. The advantage is that the memory is ready to be used by learners, provided that pedagogical and didactical choices made earlier are acceptable. This can therefore lead to a loss of flexibility, but we make the assumption that these choices can at least by shared by a community of teachers, that could act as a "community of practice".

## 3. A Course Memory

The environment of a given course or training can be seen as an organisation. Hence, different actors (teachers, learners, administrative staff, etc.) are involved in this environment. That is why, in the MEMORAe project, we propose to manage resources, information and knowledge of this kind of organisation by relying on an organisational memory and more precisely on a "course memory". This memory can be accessed by teachers when they want to re-use resources, as in a thematic resources base. But our main goal is to allow learners to directly use the memory. Let us see the contents of this memory.

### *3.1. Contents of the Memory*

The course memory contains the resources and the notions regarded as pertinent by the teaching team for a given course. It relies on two ontologies allowing to organise and index the resources.

Resources can be very different from one to another. They vary according to their size (web page or book for example), their nature (course, exercises, definitions, case studies, etc.), their form (book, report, web site, etc.), their medium (paper, video, audio, etc.), … A resource can be present in the memory, if it is digital, but it can also only be referenced, in case of non digital or external resources.

Notions are not only chosen because they are related to the course theme. They are selected on the basis of a didactical work. For example, in the context of a course on algorithms and programming, why and how to decide to establish a link between the notions of "array" and "loop" ?

Resources are selected and indexed relying on this work. Indexing is not made in an automatic way. The course manager, with the help of an editing committee if needed, is responsible for the pertinence of this link. It is not because a document treats of a notion that it will automatically be indexed by this notion. This is the result of a choice, that is to say that the document must have been judged suited for the learning of this notion. These decisions result from the pedagogical goal the course manager wants to achieve.

### *3.2. Ontologies*

We chose to model our course memory with the help of ontologies. By using ontologies, our goal is on one hand to define a vocabulary that can be shared by all the actors in order to characterize the notions to learn, and on the other hand, to organise the access to the resources (see section 4). Building an ontology is quite a complex task, which is made easier by using a method. In the Memorae project, we used the OntoSpec [6] method. OntoSpec is a method of semi-informal specification of ontologies. It supposes that a conceptualization is made up of a set of concepts (or conceptual entities) and relations. The concepts in OntoSpec are organized in a taxonomy. Sub-concepts inherit all the properties of their super-concept. The relations make it possible to connect various concepts between them. Sibling concepts are organized in semantic axes according to their similarities.

We separate two ontologies [7] : the domain ontology which concerns the domain of training organisation in a general way and the application ontology which represents what is specific to a given course or training.

The concepts of the domain ontology are answerable to different types: persons (student, teacher, administrative staff, etc.), documents (books, slides, web pages, etc.), resource access (digital, solid), pedagogical features (e.g. activity type), or means to express a point of view (e.g. annotation).

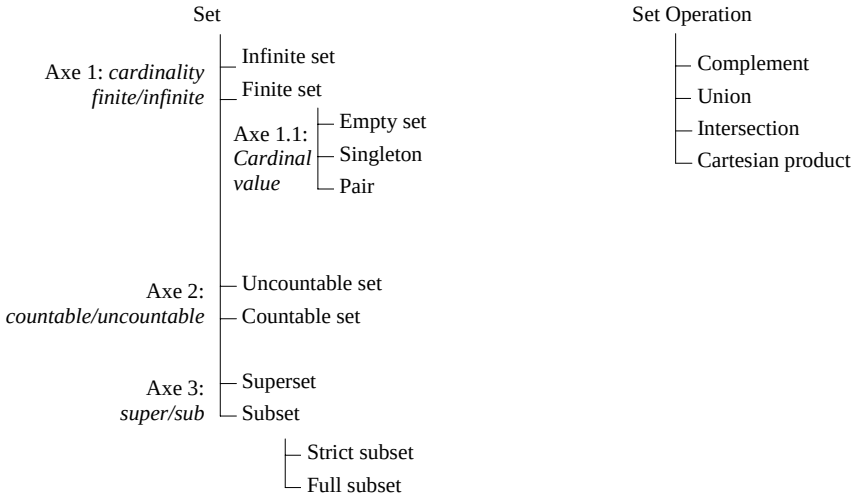


**Figure 1.** Excerpt of the B31.1 ontology

The application ontology describes the notions associated to a specific course. For example, Figure 1 shows an excerpt of the ontology of a course in applied mathematics (B31.1). An ontology is not only a taxonomy, it also includes a definition for each of the concepts, conditions on these concepts and relations between them.

Let us stress that an ontology is always constructed in connection with the application it will be used for. In the case we consider, the concepts correspond to notions to teach and to learn. There are relations between these notions, for example the “pre-requisite of” relation, that can reveal different visions on the learning domain. Therefore the ontology we have constructed is not an ontology of applied mathematics, it is an ontology of a specific course in applied mathematics. However, we think that this ontology could be reused by teachers that share the same vision of applied mathematics learning.

The domain and application ontologies are not independent; they have to be connected. For example, to express that a document is an introduction to finite sets, the concepts of “introduction” and “finite set”, that are not part of the same ontology, have to be linked. Moreover, pedagogical relations such as “pre-requisite of” or “uses” are defined

in the domain ontology, while other that are more specific are part of the application ontology (e.g. “has cardinal number” in the B31.1 ontology). See [1] for more details.

## 4. Navigation in the Memory

The navigation in the memory relies on the two ontologies. The navigation interface presents for each notion a definition, the resources that are related to it and a part of the associated ontology (parent, childs, siblings). It also shows an history of the navigation and provides some entry points that are defined by the course manager. Entry points allow to directly access to a notion in the memory.

The definition of a notion can refer to other notions. This reference corresponds in the application ontology to a neighbourhood relation (except subsumption), such as : “prerequisite of”, “suggestion”, “uses”, etc. To this end we also defined an horizontal navigation allowing to access to these notions.

## 5. Conclusion

We presented in this paper the course memory we designed in the framework of the MEMORAe project. At the opposite of the approach that is generally adopted with learning objects repositories or thematic resources bases, this course memory is bound to be directly used by learners. This implies to do earlier part of the instructional design work. Let us note however that this approach is only feasible with learners having self-regulating abilities. Some features of the course memory we propose, such as the explicit representation of the notions to learn, the indexation of adequate resources with this notions, the navigation following the relations of the ontology, and the use of a private space, aim at facilitating this self-regulation.

## References


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