

Development of a controlled vocabulary for learning objects' functional description in an educational repository

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Abstract

This paper presents the development of a controlled vocabulary for functional description in an educational repository project which has adopted a DC application profile. The vocabulary, organized according to the identified functions of educational documents and learning objects' components, permits their retrieval and reuse to be improved.

Keywords:

Dublin Core; Application profiles; Educational vocabularies; Learning objects; Reusability; Educational digital libraries.

1. Introduction

Nowadays, the global educational community has a strategic need: to share and reuse educational contents. The main goal of the DOTEINE Project ("LIS and ICT for Education: Instruments for Information Literacy and the Organization of Educational Resources") and its annex project, the IACORIE Project ("Content Analysis Instruments for the Organization of Educational Resources: LRC Knowledge for Society"), is to develop documentary tools for storing, representing, organizing and retrieving educational contents in educational settings. To accomplish this goal, we have developed a repository to gather educational digital documents that can be used at three educational levels: Secondary

Education, Undergraduate and Postgraduate. To describe these documents, we have adopted a Dublin Core application profile called MIMETA (IACORIE Metadata Model).

The most important information requirements of the educational community (1) correspond, on the one hand, to the need to retrieve educational resources and/or their components by their content matter as well as by the function they have in their original context, and on the other hand, to retrieve them at a high granularity level for reusability purposes.

To respond to these demands, several tasks must be undertaken. First, digital educational documents must be provided with analytical descriptions of a suitable depth and due preservation of context by means of proper identification of whole-part and part-whole relationships. Second, we should have at our disposal two specific controlled vocabularies: one to describe content matter and the other one to describe the different functions that document components can fulfill. However, vocabularies currently available do not take into account functional description, preventing us from carrying out functional retrieval.

This paper presents the application profile in which the new vocabulary has been integrated, previous analysis of components' functions carried out, and the vocabulary structure developed. Finally, a summary of the conclusions reached and future works is given.

2. The MIMETA Application Profile

Among its 22 elements, MIMETA gathers most of DC basic elements as well as some other elements from educational schemes (mainly the IEEE LOM, AICC, EdNA, GEM and MERLOT). The application profile was developed after a detailed analysis of the main standards and ongoing educational digital library projects (2). The elements considered for general description of resources are:

<i>Element</i>	<i>Description and use</i>
identifier	Resource identification code
author	Person or entity associated with the resource
author type	Type of authorship
institution	Institutional authorship
title	Title or name assigned to the resource
date	Date associated with the resource
date type	Type of date
language	Language of the document content
description	Free-text description of the content
format	Type of data
type	Resource type description
location	URI and/or navigation path if applicable
rights	Property rights involved
subject	Subject matter, controlled vocabulary
keywords	Keywords, free text
relation	Relationships established between resources. Relationship considered: "Is part of"

The elements considered to describe the educational characteristics are:

<i>Element</i>	<i>Description and use</i>
user type	Kind of potential user
context	Educational context/level
difficulty	Degree of difficulty associated with the resource
prerequisites	Previous knowledge required
interactivity type	Kind of interaction supported by the resource (active, expositive or combined).
pedagogical	Pedagogical methods and goals

These educational elements are considered mandatory for learning objects and optional for informative documents until they acquire educational value in a context of use, following the document differentiation explained below.

3. Learning objects' functional structure

We consider there to be two types of documents which are of use in education: on the one hand, informative documents and, on the other, the strictly speaking educational documents (3). Among the latter –educational documents oriented towards the acquisition of knowledge, skills and competencies- we find learning objects (LO). According to the principles of instructional design and the typical usage in educational communication, LO should be provided with the following generic structure (typical semantic superstructure):

Presentation: Components that set the content in context for the learner and present the educational goals aimed for.

Exposition: Components that expound the educational contents that have motivated the creation of the document.

Illustration: Components that illustrate the theoretical contents, supporting them and complementing them.

Evaluation: Components used to assess the fulfillment of the learning objectives sought.

4. The type and function controlled vocabulary

DC and IEEE LOM propose two different solutions for populating their “Type” and “Educational resource type” elements. DC recommends using its own vocabulary, the DCMI Type Vocabulary, comprising 12 terms: Collection, Dataset, Event, Image, Interactive Resource, Moving Image, Physical Object, Service, Software, Sound, Still Image and Text. However, the DCMI has also encouraged the adoption of specialized vocabularies developed within communities of practice (4). For its part, LOM proposes using the 1989 Oxford English dictionary and any other terms used in the different communities of use.

The need for an available specific, organised and limited value space for the defined retrieval purposes has led us to analyse the vocabularies available, for which the exhaustive JISC vocabulary report for CETIS was very useful (5). Having observed the lack of a convenient vocabulary for our goals, we decided to use them as a guide and terminological basis for a vocabulary constructed *ex novo*. To do this, the structural entity of documents

(units or components) and the functions identified for their components were used as a basis. It was, then, decided to organise terms in a faceted structure (6) in an attempt to reflect the multiple dimensions and diversity of educational documents, thus creating a flexible and semantically rich descriptive language.

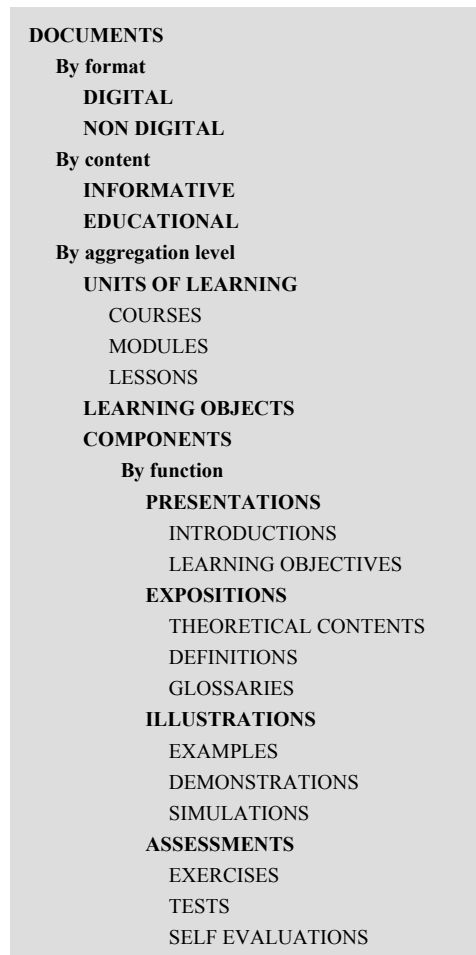


Fig. 1. Document type and function vocabulary. Hierarchical display (Extract)

The thesauri management system used by our project, Tematres (7), enables our vocabulary to be exported in Zthes and SKOS-Core format. Facets have to be solved by means of ordered collections, as shown below:

```

<?xml version="1.0" encoding="ISO-8859-1" ?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  xmlns:dc="http://purl.org/dc/elements/1.1/">
  <skos:ConceptScheme rdf:about="http://doteine.uc3m.es/tesauros/tipindex.php">
    <dc:title>Tipos y funciones de documentos educativos</dc:title>
    <dc:creator>Grupo DOTEINE</dc:creator>
    <dc:subject>TESAUROS DE EDUCACIÓN</dc:subject>
    <dc:description>Tesauro de tipos y funciones de documentos</dc:description>
  </skos:ConceptScheme>
</rdf:RDF>
  
```

```

<dc:publisher>Grupo DOTEINE</dc:publisher>
<dc:date>2006-02-02</dc:date>
<dc:language>es</dc:language>
</skos:ConceptScheme>
<skos:Concept rdf:about="http://doteine.uc3m.es/tesauros/tipoindex.php?tema=580">
<skos:prefLabel>DOCUMENTOS</skos:prefLabel>
<skos:narrower>
<skos:OrderedCollection>
<rdfs:label>Por formato</rdfs:label>
<skos:memberList rdf:parseType="Collection">
<skos:Concept rdf:about="http://doteine.uc3m.es/tesauros/tipoindex.php?tema=581"/>
<skos:Concept rdf:about="http://doteine.uc3m.es/tesauros/tipoindex.php?tema=582"/>
</skos:memberList>
</skos:OrderedCollection>
(...)
</skos:narrower>
</skos:Concept>
</rdf:RDF>

```

Fig. 2. Document type and function vocabulary in SKOS-Core (Extract)

The vocabulary developed has been used to populate the <type> element, which is by definition, a repeatable element. A sample XML record for a demonstrational video (LO component with an illustrational function) gathered in the repository is shown in the following figure:

```

<dc:format xsi:type="dcterms:IMT">Video</dc:format>
<dc:type xsi:type="dcterms:DCMIType">Moving image</dc:type>
<dc:type xml:lang="es" xsi:type="mimeta:TFT">digitales</dc:type>
<dc:type xml:lang="es" xsi:type="mimeta:TFT">componentes</dc:type>
<dc:type xml:lang="es" xsi:type="mimeta:TFT">ilustraciones</dc:type>
<dc:type xml:lang="es" xsi:type="mimeta:TFT">demonstraciones</dc:type>
<dc:subject xml:lang="es" xsi:type="mimeta:TD">Buscadores</dc:subject>
<dc:subject xml:lang="es" xsi:type="mimeta:TD">Operadores booleanos</dc:subject>

```

Fig. 3. Sample XML record (Extract)

This description enables the corresponding document to which the record refers to be retrieved. This can be useful, for instance, for teachers in need of digital videos (<format>) that illustrate (<type>) how boolean operators are used in search engines (<subject>) to integrate them into their own LOs.

5. Conclusions and future work

After analysing type, structure and function of educational documents we have constructed a controlled vocabulary that enables teachers to retrieve LO and their components with the specificity and granularity required in their tasks of content reuse for the creation of new educational content.

From this point on, several research lines must be explored. On the one hand, research is focusing on implementation of the thesauri's graphic display in a concept map manner – with richer semantic relationships linked to the corresponding resources- (8). On the other hand, query log analysis (9) will move us closer to the vocabulary actually used by users, which will surely enrich our thesauri, improving their retrieval power. Finally, we are planning to develop specific methods to evaluate the impact of the vocabulary on content reuse and, therefore, on teaching work

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6 References:

1. C.L. Borgman et al. Comparing Faculty Information Seeking in Teaching and Research: Implications for the Design of Digital Libraries. *Journal of the American Society for Information Science and Technology*, vol. 56, n. 6, 2005, pp 636-657.
2. M.A. Marzal, J. Calzada-Prado and A. Cuevas Cerveró. Desarrollo de un esquema de metadatos para la descripción de recursos educativos: el perfil de aplicación MIMETA. *Revista Española de Documentación Científica* (In press).
3. J. Calzada-Prado. Aproximación documental a los objetos de aprendizaje. In: A. Miranda and E. Simeão. *Alfabetização digital e acesso ao conhecimento*. Brasília: Universidade de Brasília, 2006, pp. 79-95.
4. S. Pockley. What's the use of DC.Type? Semantic and functional aspects of the role of DC.Type within a moving image metadata generation tool. *Proceedings of the International Conference on Dublin Core and Metadata for e-Communities*, Firenze, 13-17 October 2002, pp.245-250.
5. CETIS. *JISC Pedagogical Vocabularies Project. Report 1: Pedagogical Vocabularies Review*, 2005. Available at http://www.jisc.ac.uk/uploaded_documents/PedVocab_VocabsReport_v0p11.doc
6. ISO 2788-1986. *Documentation- Guidelines for the establishment and development of monolingual thesauri*.
7. Available at: <http://www.r020.com.ar/tematres/>
8. M.A. Marzal, M.J. Colmenero, J. Calzada-Prado and A. Cuevas Cerveró. Mapas conceptuales y presentación gráfica del tesoro: aplicación a bibliotecas educativas. *Second International Conference on Concept Mapping*. San José, Costa Rica, 5-8 October 2006.
9. J. Qin and J. Calzada-Prado. Use of learning object vocabulary in GEM queries. *Proceedings of the International Conference on Dublin Core and Metadata Applications*, Madrid, 12-15 September 2005, pp. 179-181.