

Using educational metadata in a learning repository that supports lifelong learning needs of rural SMEs

Argiris Tzikopoulos, Nikos Manouselis, Constantinos Yialouris
and Alexander B. Sideridis

Infomatics Laboratory, Agricultural University of Athens, 118 55, Athens, Greece, {tzikopoulos, nikosm, yialouris, as}@aua.gr

Abstract

ICT can be a potential solution in order to cover agricultural professionals' lifelong learning needs. An application area of particular interest is the one of digital learning repositories (DLRs). These are online databases where digital learning resources are systematically organised and classified. In such repositories, educational metadata play an important role since they allow the description and categorisation of learning resources using widely-accepted, interoperable and reusable metadata specifications and standards. In this paper, we study the design of appropriate educational metadata for a DLR that aims to support vocational training of small and medium enterprises (SMEs) in rural areas. For this purpose, a specialisation of the IEEE Learning Object Metadata (LOM) standard is introduced. The work presented in this paper is expected to provide useful insight into the use of metadata for researchers, managers and developers of learning repositories that aim to support rural development.

Key words: Distance learning, metadata, learning repositories.

1 Introduction

Information and telecommunication technologies have greatly enhanced access to learning for people living and working in rural and remote locations, which are unable to attend campus-based institutions. This fact has been widely recognized by both learning institutions and rural and remote communities for many years (Boland & Tenkasi, 1995). Internet increasingly becomes a dominant medium for learning, training and working, and learning resources are continuously being made available online in a digital format. There is a foreseen potential for agricultural stakeholders, such as small and medium enterprises (SMEs) in rural areas, from having access to such online resources. Agricultural stakeholders represent groups of potential learners with particular educational needs, which require them to be continuously trained on new topics and subjects.

Digital learning repositories (DLRs), where digital learning resources are systematically organised, classified and published online, can be a potential source for covering such lifelong learning needs (Tzikopoulos et al., 2006). Many institutions are currently engaged in developing DLRs that can be searchable and accessible from a wide audience. Examples include MERLOT (<http://www.merlot.org>), CAREO (<http://careo.netera.ca>), Online Learning Network (<http://www.onlinelearning.net>), Digital Think (<http://www.digitalthink.com>), EDNA (<http://www.edna.edu.au>), and SMETE (<http://www.smete.org>). Many of these DLRs contain digital learning resources that are related with the rural sector (Tzikopoulos et al., 2006).

Educational metadata play an important role in DLRs, since they make access to the learning resources faster, easier and more effective. To support the development of DLRs, using recognised metadata standards is important for a variety of reasons: metadata descriptions may be exchanged among different DLRs, search queries may be propagated among different (and interconnected) DLRs, and generally the integration of data from different sources is facilitated. An issue that requires particular care when developing a DLR for agricultural and rural stakeholders, is the fact that learning resources for such

Tzikopoulos, A., Manouselis, N., Yialouris, C.P., Sideridis, A.B., "Using educational metadata in a learning repository that supports lifelong learning needs of rural SMEs", to appear in Proc. of the 2007 EFITA Conference, Glaskow, UK, July 2-5, 2007.

learners have to reflect and match their special requirements (e.g. linguistic preferences, regional geographical coverage, particularity of covered topics, and educational level of addressed audience). This calls for the development of standard-based, context-specialised metadata when building a DLR for agricultural and rural stakeholders.

In this paper, we present a case study of developing such metadata. More specifically, a metadata schema for learning resources that may support the lifelong learning needs of SMEs in five European regions (i.e. Wales in UK, Aegean islands in Greece, Bradenburg in Germany, Kosciierzyna Commune in Poland, and Maribor in Slovenia) is described. The proposed schema is built based on the IEEE Learning Object Metadata standard (IEEE LOM, 2002), also taking into consideration agricultural metadata schemas such as the CGIAR LOM Core schema (CGIAR, 2005). First, the concepts of metadata and educational metadata are introduced, and a review of approaches for agricultural educational metadata is carried out. Then, the proposed metadata schema structure and elements are described. Finally, the conclusions of this study are summarised.

2 Background

2.1 Metadata

Metadata may greatly facilitate content collection, description, categorisation, location, and retrieval in the context of Web portals. It can be used to support the development of Web portal services that are based on the collection of resources. Metadata plays a critical role in such systems. It makes it easier to describe, explain, locate, or otherwise retrieve, use, or manage a resource. It is often called 'data about data' or 'information about information' (NISO, 2004; Steinacker et al., 2001). Metadata is used to provide information about resources which do not necessarily need to be displayed on the screen. It can then be used by software such as search engines or content management systems. Examples of information commonly stored as metadata include authorship, publication date, modification date, copyright information, and subject keywords. Kraan (2003), states that there is no one all-encompassing metadata schema to be used in all applications. Rather, there are various metadata schemas that can be adapted or 'profiled' to meet community context-specific needs. This conclusion has led to the emergence of the *application profile* concept. An application profile is an assemblage of metadata elements selected from one or more metadata schemas, and its purpose is to adapt or combine existing schemas into a package that is tailored to the functional requirements of a particular application, while retaining interoperability with the original base schemas (Duval et al., 2002). As a result, application profiles aim at facilitating the application-oriented implementation of educational metadata specifications by allowing the designers to 'mix and match' metadata schemas as appropriate (Duval et al., 2002; Duval & Hodgins, 2003).

2.2 Educational metadata

As mentioned earlier, DLRs are databases of educational resources in a digital format, which are systematically organized to facilitate searching and retrieval. Learning repositories may contain online courses, best practices, presentations, reports, textbooks, and other forms as well. During the last few years, numerous repositories have been developed worldwide, offering access to learning resources and covering various educational topics. Examples of these topics include computing, business, art, engineering, technology and agriculture. Educational metadata can significantly assist the effective retrieval of educational resources. The evolving need for introducing educational metadata for the description of learning resources has grown to become a requirement for the design and development of DLRs (Karampiperis & Sampson, 2003). Educational metadata are attracting increasing attention in this context, since they facilitate the description of educational resources, so that they can be easily retrieved (Greenberg, 1999; Bourda & Hilier, 2000).

2.3 Approaches for agricultural learning resources

A common vision that may serve as an enabler for sustainable development, environmental preservation, and fighting hunger in the world, is the involvement, collaboration and coordination of activities dealing with the production, organisation and exchange of agricultural resources. In this direction, initiatives such

Tzikopoulos, A., Manouselis, N., Yialouris, C.P., Sideridis, A.B., “Using educational metadata in a learning repository that supports lifelong learning needs of rural SMEs”, to appear in Proc. of the 2007 EFITA Conference, Glaskow, UK, July 2-5, 2007.

as the Agricultural Information Management Standards (AIMS) of the Food and Agriculture Organisation of the United Nations (FAO) have been launched to involve as wide a sector of the agricultural community as possible (<http://www.fao.org/aims/>). The use of agricultural metadata standards makes it easier to integrate data from different sources allowing for creation of value added services such as simple aggregated subject-based views, automatic news feed services etc. Important results have been produced as an outcome of this collaborative effort, and are already put in practice around the world.

There have been several approaches in developing educational metadata schemas or application profiles for agricultural learning resources. Several approaches are application profiles of the IEEE LOM standard. For instance, the CGIAR LOM Core has been created by the Consultative Group on International Agricultural Research (CGIAR) in order to describe its learning resources in a manner that best suits its content, purpose and audience (<http://learning.cgiar.org/>). Another IEEE LOM application profile is the one from the Bio@gro initiative (<http://www.bioagro.gr>) which was created in order to categorise available online educational resources that are related with Organic Agriculture topics. A recent approach is FAO’s Learning Resources Metadata (http://www.fao.org/aims/ap_applied.jsp), which is based on Dublin Core metadata standard (<http://www.dublincore.org>), also borrowing some elements taken from IEEE LOM.

3 The ReGov LOM application profile

In the context of the Rural-eGov initiative (<http://rural-egov.eu>), the ‘Rural e-Gov Observatory’ is going to be developed. This online observatory will include a DLR with resources for the vocational training of rural SMEs on e-Government services and technologies, allowing users to search, locate and access listings of of training resources. This requires the development of an appropriate metadata schema that will implemented to support the DLR functionalities. For the description and classification of the digital training objects (DTOs) of the DLR, an application profile of the IEEE LOM standard is being developed. More specifically, the Rural-eGov IEEE LOM application profile or *ReGov LOM* is proposed.

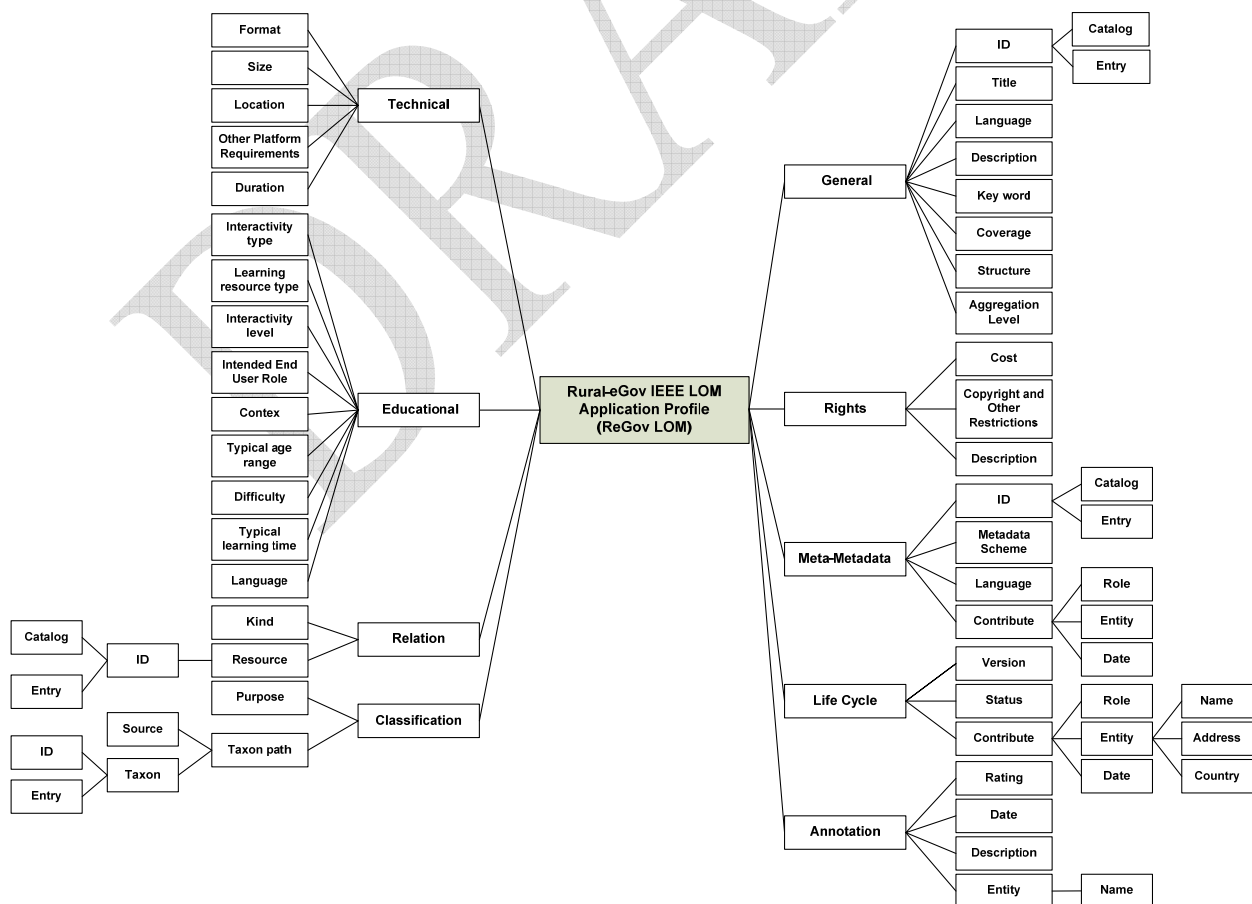


Fig. 1 An overview of the proposed ReGov LOM application profile

Tzikopoulos, A., Manouselis, N., Yialouris, C.P., Sideridis, A.B., "Using educational metadata in a learning repository that supports lifelong learning needs of rural SMEs", to appear in Proc. of the 2007 EFITA Conference, Glaskow, UK, July 2-5, 2007.

The proposed ReGov LOM follows the structure of IEEE LOM and consists of 9 categories of elements. The first one, **General**, is a category including elements that describe the DTO and store general information about its title, description, keyword etc. It includes the following elements:

Identifier: A globally unique label that identifies this DTO. It serves as a unique reference that can be used to identify the DTO. It contains the elements *Catalog* (storing the name or designator of the identification or cataloging scheme for this entry) and *Entry* (storing the value of the identifier within the identification or cataloging scheme that designates or identifies this DTO).

Title: It refers to the name that is given to this DTO.

Language: The primary human language or languages used within this DTO to communicate to the intended user.

Description: A description of the content of this DTO.

Keyword: A keyword or phrase describing the topic of this DTO. It will contain one or more keywords that belong to the AGRIS Subject Categories (<http://www.fao.org/scripts/agris/c-categ.htm>).

Coverage: It stores information about the time, culture, geography or region to which this DTO applies. In our case we will use only the regions where the DTOs are expected to be located. The 'Coverage' element is expected to take values from a pre-defined vocabulary of countries and/or regions, such as the European regions from NUTS Region Codes (<http://ec.europa.eu/comm/eurostat/ramon/nuts/>).

Structure: Underlying organizational structure of this DTO.

Aggregation Level: The functional granularity of the DTO. It indicates the degree to which, the DTO represents a grouping of DTOs and the degree to which, it could be broken down into smaller components.

The second category is **Life Cycle** and describes the history and current state of this DTO and those entities that have affected this DTO during its evolution. It includes the following elements:

Version: It stores a unique descriptor that denotes the version/edition of the DTO.

Status: The completion status or condition of this DTO.

Contribute: Those entities (i.e., people, organizations) that have contributed to the state of this DTO during its life cycle. It includes the sub-element *Role* (kind of contribution), *Entity* (storing the identification of and information about entities contributing to this DTO), and *Date* (storing the date of the contribution).

The third category is **Meta-Metadata**, which describes this metadata record itself (rather than the DTO that this record describes). This category describes how the metadata instance can be identified, who created this metadata instance, how, when, and with what references. It includes:

Identifier: Stores a unique label that identifies the metadata record from others in a classification system. It consists of the sub-elements *Catalog* (storing the name or designator of the identification or cataloging scheme for this entry) and *Entry* (storing the value of the identifier within the identification or cataloging scheme that designates or identifies this metadata record).

Contribute: Describes those entities that have affected the state of this metadata instance during its life cycle (e.g., creation, validation) as well as additional information about when this metadata record has been created, modified or published. It consists of the sub-elements *Role* (storing the role of the entity that creates, modifies, or validates a metadata record), *Entity* (storing the identification of and information about entities contributing to this metadata instance), and *Date* (storing the date of the contribution).

Metadata Schema: The name and version of the authoritative specification used to create this metadata instance.

Language: Language of this metadata instance. It takes values from a pre-defined vocabulary of languages, such as the ISO code set 639-2.

The fourth category is **Technical** and describes the technical requirements and characteristics of this DTO. It includes the following sub-elements:

Format: Technical datatype(s) of this DTO. This data element shall be used to identify the software needed to access the DTO. It takes values from a pre-defined vocabulary which follows the technical formats used in FAO's Learning Resources Metadata.

Size: The size of the digital DTO in bytes (octets). The size is represented as a decimal value.

Location: A string that is used to access this DTO. This element describes the location of the resource within the repository.

Other Platform Requirements: Information about other software and hardware requirements.

Duration: Time a continuous DTO takes when played at intended speed..

Tzikopoulos, A., Manouselis, N., Yialouris, C.P., Sideridis, A.B., "Using educational metadata in a learning repository that supports lifelong learning needs of rural SMEs", to appear in Proc. of the 2007 EFITA Conference, Glaskow, UK, July 2-5, 2007.

The fifth category is **Educational** and describes the key educational or pedagogic characteristics of this DTO. It includes:

Interactivity Type: Predominant mode of learning supported by this DTO (e.g. active, expositive or mixed).

Learning Resource Type: Specific kind of DTO (e.g. exercise, simulation, questionnaire, exam, experiment, etc.). The most dominant kind shall be first.

Interactivity Level: The degree of interactivity characterizing this DTO (e.g. low, medium, high). Interactivity in this context refers to the degree to which the learner can influence the aspect or behavior of the DTO.

Intended End User Role: Principal user(s) for which this DTO was designed, most dominant first (e.g. farmer, regional authority, trainer, teacher, etc.).

Context: The principal environment within which the learning and use of this DTO is intended to take place (e.g. vocational training, school, higher education etc.).

Typical Age Range: The age of the typical intended user of the DTOs for which this approach applies (e.g. '7-9', 'suitable for adults only', etc.). This data element shall refer to developmental age, if that would be different from chronological age.

Difficulty: How hard it is to work with or through this DTO for the typical intended target audience.

Typical Learning Time: Approximate or typical time it takes to work with or through this DTO for the typical intended target audience.

Language: The human language used by the typical intended user of this DTO.

The sixth category is **Rights**, which describes the intellectual property rights and conditions of use for this DTO. It includes:

Cost: Whether use of this DTO requires payment or not.

Copyright and Other Restrictions: Whether copyright or other restrictions apply to the use of this DTO.

Description: Comments on the conditions of use of this DTO and whether copyright or other restrictions apply to the use of this DTO.

The seventh category is **Relation** and defines the relationship between this DTO and other DTOs. It includes:

Kind: Nature of the relationship between this DTO and the target DTO, defined using a vocabulary value such as 'requires' or 'is translation of'.

Resource: The target DTO that this relationship references. It is defined by using an *Identifier* sub-element that referring to the globally unique label that identifies the target DTO (consisting from a *Catalog* and an *Entry* sub-element).

The eighth category is **Annotation**. It provides comments on the educational use of this DTO, and information on when and by whom the comments were created. This category enables educators to share their assessments of DTOs, rate them using a numerical scale, indicate suggestions for use, etc. It includes the following sub-elements:

Entity: Entity (i.e., people, organization) that created this annotation. In ReGov LOM it is defined by using the sub-element *Name* that stores the name or title of entity (person, organization, etc.).

Date: the date this annotation was created.

Description: the content of the annotation, such as the comments or textual review.

Rating: the numerical assessment of the DTO by the entity.

The last category is **Classification**. It is used to describe where this DTO falls within a particular classification system. In ReGov LOM, DTOs are classified according to the economic activities or business sectors to which they are relevant, following the NACE Codes of Economic Activity (<http://www.top500.de/nace4-e.htm>). This category includes the following sub-elements:

Purpose: The purpose of classifying this DTO.

Taxon Path: A taxonomic path in the selected classification system. Each succeeding level is a refinement in the definition of the preceding level. It is defined using the sub-elements *Source* (which stores the name of the classification system, i.e. NACE Codes of Economic Activity) and *Taxon* (which contains a particular term within a taxonomy, e.g. '012 Farming of animals').

4 Conclusions

Tzikopoulos, A., Manouselis, N., Yialouris, C.P., Sideridis, A.B., "Using educational metadata in a learning repository that supports lifelong learning needs of rural SMEs", to appear in Proc. of the 2007 EFITA Conference, Glaskow, UK, July 2-5, 2007.

This paper introduced the ReGov LOM application profile, a specialisation of the IEEE LOM standard used to support the description and classification of learning resources for rural SMEs in the Rural-eGov Observatory. First, the concepts of metadata and educational metadata have been introduced, and characteristic schemas storing educational metadata for agricultural resources were described. Then, the structure and elements of the proposed ReGov LOM schema were presented. The work presented in this paper may be found useful by researchers, managers and developers of DLRs that aim at agricultural and rural stakeholders, such as the rural SMEs of the Rural-eGov project.

5 Acknowledgement

The work presented in this paper has been funded with support by the European Commission, and more specifically the project No EL/06/B/F/PP-148238 "Rural e-Gov: Training SMEs of Rural Areas in using e-Government Services" of the Leonardo da Vinci (LdV) Programme. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein. The authors would like to thank all the consortium partners for their contribution in the design and implementation of this initiative.

6 References

- Boland, R., Tenkasi, R., 1995. Perspective Making and Perspective Taking in Communities of Knowing. *Organization Science* 6 (4), pp. 350-372, July-August.
- Bourda, Y., Hilier, M., 2000. What Metadata and XML can do for Learning Objects. *WebNet Journal: Internet Technologies, Applications and Issues* 2 (1).
- CGIAR, 2005. CG Learning Object Metadata (LOM) Core. Thomas Zschocke, Courtney Paisley, Erik Duval and Jan Beniest, ICT/KM OLR Project November.
- Duval, E., Hodgins, W., 2003. A LOM research agenda. In Proc of the 12th International World Wide Web Conference, Budapest, Hungary.
- Duval, E., Hodgins, W., Sutton, S., and Weibel, SL., 2002. Metadata Principles and Practicalities. *D-Lib Magazine*, 8 (3).
- Greenberg, J., 1999. Metadata and Organising Educational Resources on the Internet. *Journal of Internet Cataloging*, 3 (1).
- IEEE LOM, 2002. Draft standard for learning object metadata. IEEE Learning Technology Standards Committee, IEEE 1484.12.1-2002, 15 July.
- Karampiperis, P., Sampson, D., 2003. Enhancing Educational Metadata Management Systems to support Interoperable Learning Object Repositories. in Proc. of the 3rd IEEE International Conference on Advanced Learning Technologies (ICALT 2003), ISBN: 0769519679, pp. 214-218, Athens, Greece, IEEE Computer Society, July.
- Kraan, W., 2003. The one standard, LOM and the semantic web. CETIS. <http://www.cetis.ac.uk/content/20030127164729> last accessed January 2007
- NISO, 2004. Understanding Metadata. National Information Standards Organisation, NISO Press.
- Steinacker, A., Ghavam, A., Steinmetz, R., 2001. Metadata Standards for Web-Based Resources. *IEEE Multimedia*, January-March, pp. 70-76.
- Tzikopoulos, A., Manouselis, N., Yialouris, C., Costopoulou, C. Sideridis, A., 2006. Investigating Digital Learning Repositories' Coverage of Agriculture-related Topics. in Proc. of the International Congress on Information Technologies in Agriculture, Food and Environment (ITAFE05), Adana, Turkey October 12-14, 2005.