

Towards a harmonization of metadata application profiles for agricultural learning repositories

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Abstract

Metadata interoperability allows the exchange and preservation of crucial learning and teaching information, as well as its future reuse among a large number of different systems and repositories. This paper introduces work around metadata interoperability that has taken place in the context of the Agricultural Learning Repositories Task Force (AgLR-TF), an international community of the stakeholders that are involved in agricultural learning repositories. It particularly focuses on a review and assessment of metadata application profiles that are currently implemented in agricultural learning repositories. The results of this study can be found useful by who are designing, implementing and operating agricultural learning repositories, facilitating thus metadata interoperability in this application field.

Keywords: metadata, application profile, agriculture, learning repository.

1. Introduction

In the education and training context, metadata interoperability has been judged as an essential issue. It allows the exchange and preservation of crucial learning and teaching information (such as competency profiles, learning activities, and descriptions of learning resources), as well as its future reuse among a large number of different systems and repositories. Recent standardization and specification efforts in the area of learning technologies have contributed to this direction. At the level of sharing, exchanging and reusing learning resources among different Learning Management Systems (LMSs) and Learning Repositories (LRs), learning technologies aim to preserve a high level of interoperability by implementing relevant standards and specifications such as the IEEE Learning Object Metadata (IEEE LOM, 2002), Dublin Core (DC, 2004) and its educational element set, and the recently introduced ISO Metadata for Learning Resources (ISO/IEC MLR, 2005). On the other hand, in the field of agricultural education and training, learning technology (LT) specifications and standards have not been yet widely adopted. Few initiatives have reported implementing them, and in most cases only to describe learning resources by using IEEE LOM, DC or a combination of the two (Stuempel et

al., 2007). In addition, until now efforts have been distributed and dispersed, leaving space to approaches with significant differences between them.

This paper focuses on metadata interoperability for describing agricultural learning resources. It first introduces the Agricultural Learning Repositories Task Force (AgLR-TF), an initiative that has been launched to connect and mobilize international stakeholders involved in agricultural learning repositories. It outlines the vision of AgLR-TF to create a network of organizations which will promote the development of a global infrastructure that will facilitate sharing and reusing of learning resources, on topics related to agricultural and rural development worldwide. Then, the paper focuses on one particular activity that is taking place in the context of AgLR-TF: the review and assessment of the metadata application profiles (APs) that are currently used for describing learning resources in agricultural learning repositories. It describes how this activity has led to the development of guidelines and recommendations for designing and implementing future APs for agricultural learning repositories in such a way that their interoperability is facilitated. It also describes how this activity has led to the development of a meta-mapping framework that will facilitate the interoperability and communication of learning repositories that use different schemas.

2. AgLR-TF Activities & Results

AgLR-TF is setting up a network of organizations for promoting the development of learning repositories on agricultural and rural development topics, by offering them a global infrastructure that will facilitate sharing and reusing of learning resources. It aims at joining the forces of leading organizations around the world in order to provide guidance, standards, technologies, tools, recommendations, and best practices for building agricultural learning repositories. In this way, AgLR-TF intends to make learning resources on topics essential for the development and welfare of agricultural and rural populations around the world, available online on a global scale. At its launch (on February 2008), AgLR-TF aimed at organizing a variety of activities within 2008:

1. Building a community of organizations and individuals activating in the field of agricultural learning repositories;
2. Creating an inventory of agricultural learning repositories around the world;
3. Organizing an e-conference on agricultural learning repositories;
4. Producing an initial set of best practice recommendations, concerning implementing interoperable metadata in agricultural learning repositories;
5. Deploying a pilot demonstrator of federating learning repositories on a global scale.

Until today, significant progress has been made as far as these activities are concerned.

2.1. Community building

The web site that has been set up for promoting the community-building activity, and allowing individuals and/or organisations to get involved in the Agricultural Learning Repositories Task Force (AgLR-TF), is presented in Figure 1. In addition, a D-Groups mailing list has been set up to facilitate communication and information dissemination among the AgLR-TF members (<http://www.dgroups.org/groups/fao/Ag-LR-TF/>). Until today, over twenty (20) organizations

from around the world have expressed their support to the activities of the AgLR-TF (<http://aglr.aua.gr/node/11>). Furthermore, more than one hundred (>100) people have registered to the community of the AgLR-TF. These members are coming from twenty-six (26) different countries.



AgLR-TF Agricultural Learning Repositories Task Force
Learning Resources for the Development & Welfare of Rural Populations

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Facilitated by: 

Home

Welcome to the online space of the Agricultural Learning Repositories Task Force (AgLR-TF). This is a community initiative developed under the umbrella of the **Agricultural Information Management Standards (AIMS)** initiative of the Food and Agriculture Organization of the United Nations.

The AgLR-TF is an open community where all organizations and individuals that are active in the field of agricultural learning repositories may participate in the promotion and development of a global infrastructure to facilitate sharing and reusing of learning resources on topics related to agricultural and rural development. Find more about the aims of the AgLR-TF in the Vision section.

[Join the AgLR-TF.](#)

The Agricultural Learning Repositories (AgLR 2008) E-Conference has been concluded

The aim of the AgLR 2008 e-Conference has been to initiate the dialogue around the topic of Agricultural Learning Repositories, involving organizations and individuals that are active in the field of agricultural learning repositories. AgLR 2008 took place as electronically facilitated discussion. To view the e-mail archive of the discussion, you may register as a member of AgLR-TF. A report that summarizes the major ideas and contributions can be [downloaded from here](#) (in PDF format).

AgLR 2008 has been the first of a series of events that will be supported and promoted by AgLR-TF. For more information about past and scheduled events, please [click here](#).

Fig. 1. Web site of the AgLR-TF (<http://aglr.aua.gr>).

2.2. Inventory of repositories

An online registry for agricultural learning repositories has been included (<http://aglr.aua.gr/node/19>) and invitations have been sent to relevant stakeholders to register their repositories. By July 2008, ten (10) repositories were registered to the AgLR-TF site.

2.3. e-Conference

An *Agricultural Learning Repositories E-Conference (AgLR 2008)*, (<http://aglr.aua.gr/econf.php>) was organized during April 24 – June 15, 2008. AgLR 2008 aimed to initiate the dialogue around these topics, involving organizations and individuals that are active in the field of agricultural learning repositories. It was held as an electronically facilitated discussion that took place through the D-Groups mailing list. It explored the needs and requirements of stakeholders involved in the development and operation of agricultural learning repositories. As a follow up to the AgLR 2008 e-conference, a physical event has been scheduled for September 19th, 2008. It is the *Workshop on Learning Technology Standards for Agriculture and Rural Development (AgroLT 2008)*, (<http://infolab-dev.aua.gr/agrolt/2008/>)..

2.4. Best practices & recommendations

A survey of the metadata schemas has been carried out, in cooperation with the European Standardization Committee CEN/ISSS, and more specifically the Workshop on Learning Technologies (WS-LT, <http://www.cen.eu/iss/workshop/lt/>). A group of WS-LT experts has been formed, which reviewed, assessed, and validated the results of the survey. As an outcome, a technical report on “*Guidelines and recommendations for building metadata application profiles for agricultural learning resources*” has been prepared. This report aims to provide an overview of the way metadata application profiles are implemented in agricultural learning repositories around the world. In addition, it also aims to review and validate the approaches followed, so that it provides guidelines and recommendations to existing or new developers of agricultural repositories.

2.5. Demo application

In order to develop the demo application that will exhibit how information from one repository can be presented (harvested) in another, a liaison has been made with the Organic.Edunet European project (<http://www.organic-edunet.eu>) and the ARIADNE Foundation (<http://www.ariadne-eu.org/>). The goal has been to set up a pilot demonstrator showing how repositories can exchange their metadata by applying protocols such as the Open Access Initiative Protocol for Metadata Harvesting (OAI-PMH, <http://www.openarchives.org/OAI/openarchivesprotocol.html>). To this end, a set of metadata records from the repository of FAO’s Capacity Building Portal (www.fao.org/capacitybuilding/) has been harvested into a demo Organic.Edunet repository. This demo repository has been made available for harvesting from the ARIADNE federation, so that its metadata records are made available through the federated search interfaces of ARIADNE (<http://ariadne.cs.kuleuven.be/silo2006/NewFederatedQuery.do>).

3. Metadata application profiles for agricultural learning repositories

As mentioned earlier, the survey of metadata application profiles that took place within the AgLR-TF community has been combined with a parallel expert group validation activity has been formulated in the context of the CEN/ISSS WS-LT. More specifically, WS-LT decided in its meeting of February 2008 to set up a formal liaison with AgLR-TF. From the WS-LT perspective, the aim of this liaison was to further promote the adoption and implementation of LT specifications and standards in learning repositories that support the needs of rural and agricultural populations.

Based on the work carried out in the CEN Workshop Agreement 15555 “*Guidelines and support for building application profiles in e-learning*” (CWA, 2006), it was agreed to set up a joint project team that will review implemented metadata APs for a sample of popular agricultural repositories (including the ones registered to AgLR-TF), in the light of the guidelines of CWA 15555. Then, it would try to elaborate a set of recommendations for achieving better interoperability between them.

Overall, the following APs have been identified: (i) Rural-eGov IEEE LOM AP (*ReGov LOM*); (ii) FAO Agricultural Learning Resources AP (*FAO Ag-LR*); (iii) CGIAR LOM Core

AP (*CG LOM Core*); (iv) *BIOAGRO LOM AP*; (v) Biosci Education Network (*BEN AP*); (vi) Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (*SANREM CRSP AP*); (vii) *TrAgLor LOM AP*; (viii) Intute: Health and Life Sciences AP (*Intute AP*); and (ix) *EcoLearnIT LOM AP*. From those, it was possible to analyze in detail only the first six. For the *TrAgLor LOM AP* only a preliminary analysis took place, based on existing information (such as a database instance of its implementation). For the *Intute AP* and the *EcoLearnIT LOM AP* no analysis was possible (they are listed here for reference reasons) since no formal documentation was at hand.

In the next sections, we present the main two outcomes of our analysis. The first outcome is a list of suggestions/recommendations for the developers of agricultural learning repositories who are implementing some metadata AP. The second outcome is an elaboration of a mapping between the elements of the various APs. More detailed results of this work can be found in Manouselis et al. (2008).

3.1. Suggestions for implementers

Based on the analysis of the sample of APs and the directions of relevant literature (e.g. CWA 2006, Najjar et al., 2004), we could come up with the following suggestions/recommendations to the designers/developers of metadata APs for AgLRs (Manouselis et al., 2008):

1. Always provide supportive documentation describing the AP. Supportive documentations offer and allow an overview for the selection and reference for detailed analysis within the adoption phase.
2. Include in documentation reference to the technical implementation of the AP and provide any relevant technical bindings. References to technical implementations and provided technical bindings facilitate the implementation and the technical interoperability.
3. Include in documentation supportive use cases that help clarify its scope, purpose and users. Use cases support the selection process during the comparison of AP candidates and provide information about implementation potentials.
4. Use the latest and more stable version of the base schema available. Different versions of metadata specifications and/or standards often have important differences that do not ensure backwards compatibility. When starting an implementation project, it is suggested that AP designers/implementers chose the latest and more stable version of the base schema that is publicly available. For instance, in one examined case, although the project was initiated after the publication of the IEEE LOM standard in 2002, a previous version of LOM has been used.
5. When ad hoc or extended value spaces are used for some elements, it is required to make the new value spaces available in a public namespace, in order for conformance to be maintained. Public availability is needed to ensure interoperability of future APs by allowing references to these published namespaces.
6. Instead of substituting the '*Langstring*' datatype with the simpler '*Characterstring*', it is suggested that simplicity is sought through appropriate interface design. For instance, when the type is changed from '*Langstring*' to '*Characterstring*', then implementers have to make sure that during a transformation/mapping the stored values for these elements are transformed into '*Langstring*' datatypes in order to avoid information loss.

7. The non-allowed modification rules of CWA 15555 (CWA, 2006) should be carefully respected, because breaking them can lead to problems when trying to export/exchange metadata. For instance, an extension to the cardinality of an element can lead to loss of information during a transformation/mapping.
8. The elements most often occurring as mandatory in the existing APs should be considered for use also in other APs, to facilitate information exchange and interoperability. It is most probable that the information that is considered important in all other agricultural APs will also be important for a new one as well. To achieve interoperability in metadata exchange, information about a characteristic that is stored in all other APs will have to be stored for a new AP as well.

| IEEE LOM | ReGov LOM | BIOAGRO LOM | CG LOMCore | BEN | TrAgLOR |
|------------------------------|------------------------------|--------------------------|------------------------------|------------------------------|------------------------------|
| 1. General | 1 General | 1 General | 1. General | 1. General | 1. General |
| 1.1 Identifier | 1.1 Identifier | Identifier | 1.1 Identifier | 1.3 Catalog Entry | 1.3 Catalog Entry |
| 1.1.1 Catalog | 1.1.1 Catalog | | 1.1.1 Catalog | 1.3.1 Catalog | 1.3.1 Catalog |
| 1.1.2 Entry | 1.1.2 Entry | Entry | 1.1.2 Entry | 1.3.2 Entry | 1.3.2 Entry |
| 1.2 Title | 1.2 Title | Title | 1.2 Title | 1.2 Title | 1.2 Title |
| 1.3 Language | 1.3 Language | Language | 1.3 Language | 1.4 Language | 1.4 Language |
| 1.4 Description | 1.4 Description | Description | 1.4 Description | 1.5 Description | 1.5 Description |
| 1.5 Keyword | 1.5 Keyword | Keyword | 1.5 Keyword | 1.6 Keyword | 1.6 Keyword |
| 1.6 Coverage | 1.6 Coverage | Coverage | 1.6 Coverage | 1.7 Coverage | 1.7 Coverage |
| 1.7 Structure | 1.7 Structure | | 1.7 Structure | 1.8 Structure | 1.8 Structure |
| 1.8 Aggregation Level | 1.8 Aggregation Level | Aggregation Level | 1.8 Aggregation Level | 1.9 Aggregation Level | 1.9 Aggregation Level |
| 2. Life Cycle | 2. Life Cycle | 2. Life Cycle | 2. Life Cycle | 2 Life Cycle | 2. Life Cycle |
| 2.1 Version | 2.1 Version | | 2.1 Version | 2.1 Version | 2.1 Version |
| 2.2 Status | 2.2 Status | | 2.2 Status | 2.2 Status | 2.2 Status |
| 2.3 Contribute | 2.3 Contribute | Contribute | 2.3 Contribute | 2.3 Contribute | 2.3 Contribute |
| 2.3.1 Role | 2.3.1 Role | Role | 2.3.1 Role | 2.3.1 Role | 2.3.1 Role |
| 2.3.2 Entity | 2.3.2 Entity | Entity | 2.3.2 Entity | 2.3.2 Entity | 2.3.2 Entity |
| 2.3.3 Date | 2.3.3 Date | | 2.3.3 Date | 2.3.3 Date | 2.3.3 Date |
| 3. Meta-Metadata | 3. Meta-Metadata | 3. Meta-Metadata | 3. Meta-Metadata | 3 Meta-metadata | 3. Meta-Metadata |
| 3.1 Identifier | 3.1 Identifier | | 3.1 Identifier | 3.2 Catalog Entry | 3.2 Catalog Entry |
| 3.1.1 Catalog | 3.1.1 Catalog | | 3.1.1 Catalog | 3.2.1 Catalog | 3.2.1 Catalog |
| 3.1.2 Entry | 3.1.2 Entry | | 3.1.2 Entry | 3.2.2 Entry | 3.2.2 Entry |
| 3.2 Contribute | 3.2 Contribute | Contribute | 3.2 Contribute | 3.3 Contribute | 3.3 Contribute |
| 3.2.1 Role | 3.2.1 Role | Role | 3.2.1 Role | 3.3.1 Role | 3.3.1 Role |

Fig. 2. A sample of the elements of LOM-based APs mapped to LOM standard's elements.

3.2. Elaboration of mappings

The next step has been the elaboration of mappings of all studied APs with the two base schemas that they have been developed upon (i.e. LOM and DC). An example of the way these mappings have been carried out is presented in Figure 2, where the LOM-based APs are mapped against the elements of the LOM standard. In a similar way, the DC-based APs were mapped against the DC element set. From this exercise, it has been made possible to: (a) identify the main mappings between the elements of the agricultural APs, creating thus a meta-mapping framework that helps us map the elements of each individual AP into another AP; and (b) to identify a number of elements that seem to be used more often in agricultural APs, creating thus an element set that all agricultural APs should take into consideration. The elements that seem to be appearing more often as mandatory or recommended ones in the sample of agricultural APs are the following:

- Most of the APs are using some element to store an *identifier* of the resource. In some cases, this is only a URL (in other cases, a formal catalog system can also be used).

- As far as the rest of the **general characteristics** of the resource are concerned, the following information is usually stored:
 - *Title*;
 - *Language*;
 - *Description*;
 - *Keyword* (free text or restricted);
 - *Coverage* (geographical/spatial or temporal).
- As far as the **life cycle** of the resource is concerned, the following information is usually stored:
 - Role of the *entities that have contributed* to the resource;
 - *Information about* these entities;
 - *Date* of contribution/production/publication.
- As far as the **technical characteristics** of the resource are concerned, the following information is usually stored:
 - *Technical format*;
 - *Technical location* (such as URL), when the Identifier element is not used for this purpose;
 - *Size*;
 - Some *technical requirements* for its viewing/execution.
- As far as the **educational characteristics** of the resource are concerned, the following information is usually stored:
 - *Type of the learning resource*;
 - *Intended end user role*;
 - *Educational context/level*.
- As far as the **copyrights** of the resource are concerned, the following information is usually stored:
 - *Cost*;
 - *Copyrights and restrictions in use*.
- As far as the **formal classification** of the resource is concerned, the following information is usually stored:
 - *Purpose* of classification;
 - The *classification system* used (very often AGROVOC or some other agricultural knowledge organization scheme);
 - *Terms* used from the selected classification system.

4. Conclusions

This paper introduced AgLR-TF, an international community of the stakeholders that are involved in agricultural learning repositories. Then, it focused on one particular activity that is taking place in the context of AgLR-TF, a review and assessment of the metadata APs that are currently implemented in agricultural learning repositories. This activity has been supported by an expert group that was set up by the European CEN/ISSS WS-LT. The paper particularly focused on how this cooperation between AgLR-TF and WS-LT resulted into a number of useful suggestions/recommendations for implementers of such APs, as well as the identification of mappings between the elements of the agricultural APs. In this way it was possible to create a meta-mapping framework that may help in mapping the elements of each individual AP into another AP. It was also made possible to identify a number of elements that seem to be used

more often in these agricultural APs. The results of this work can give support and feedback to the people that are designing, implementing and operating agricultural learning repositories around the world, so that metadata interoperability can be achieved between them.

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