

# An Open “Materials” Repository and Global Search System: Preparing for Diverse Learners and a Variety of Learning Processes

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## Introduction

### The Present

The learning environments of lifelong learners are drastically changing due to the implementation of information and communication technologies (ICT). With the progress of Open Educational Resources (OER; cf. OECD 2007; D'Antoni 2007) combined with the power of e-publishing through e-books and e-journals, learners have gained access to a vast store of information and learning content, available at numerous repositories in the world. Nonetheless, the quality of the content stored can be questioned.

Successful lifelong learners are often independent, autonomous and self-directed. In addition, many live in distant and isolated areas. They have to visit many websites and compare information among pages before accessing what they believe to be optimal content. In order for their independent efforts to be successful, they can benefit from the guidance and recommendations of both educators and librarians, as well as other learners.

### The Future

It would be unrealistic to expect most individual learners to assess correctly the quality and relevancy of any learning content for themselves. By analysing a learner's profile (including, e-portfolio) and the context, computer programmes can aid in finding the most appropriate modules from content repositories available worldwide. Actual courseware can be organised in a modular fashion, sometimes by learners themselves, and stored in an e-portfolio as an artifact. In this process, course providers can control the pedagogical designs and rules and which materials are to be used, but not the courseware itself. Any teacher can

find the most appropriate materials, which she or he uses in the classroom after consulting with the knowledge base with respect to the pedagogy, quality and use rights, as well as colleagues' practices and recommendations. In both cases, users can concentrate more on learning and teaching, even in a variety of contexts.

Such a system could take into account a broad spectrum of personal characteristics such as age, interests, achievement levels, the learner's objectives and goals, the learning environments, learning styles and strategies. This system, which supports learners or teachers with the selection of the most appropriate content, should have some functions for personalisation and optimisation in order to support an optimal learning process for each lifelong learner.

The repositories will begin the sharing and distribution even in material and module levels. The rapid propagation of e-publishing and social media shows the possibilities of fusion of open and proprietary learning objects. In this context, a more holistic distribution infrastructure and marketplace will be necessary.

## **Background**

### **OUJ and OER Community**

The Open University of Japan (OUJ) is a national core institution both for lifelong learning and for open education. As a distance education institution, OUJ has multiple delivery channels for course materials. It has housed a television and radio station since 1978 that broadcasts video and audio course materials free of charge. In addition to these traditional delivery channels, OUJ distributes content via the Internet.

The content is digitised and stored in a repository and consists of about 42 per cent of the TV courses and all of the radio courses (71 of 169 TV courses and 157 of 157 radio courses as of October 2011), which is available only to students as "closed" content, as streaming video or audio. Nevertheless, OUJ launched "OUJ OpenCourseWare (OUJ-OCW)" in 2010 and opened some of this digital content via the Internet in order to contribute through OER movements to the lifelong learning society (21 courses available as OUJ-OCW as of July 2012).

Another contribution of OUJ to the OER community is that it has made available a cross-institutional search system. In Japan, the National Institute of Multimedia Education (NIME, the forerunner of the Center of ICT and Distance Education [CODE] at OUJ) started an educational information portal service with content and metadata repository functions primarily for higher education in 2003 (Yamada et al. 2003; Yamada et al. 2004). In March 2005, NIME launched a new gateway service on Japanese educational content, called "NIME-glad (Gateway to Learning for Ability Development; cf. Yoshii et al. 2008). In the same framework, NIME also started "JOCW Search" in October 2006 for the Japan OpenCourseWare Consortium (JOCW). NIME collects OCW content in collaboration with JOCW member organisations and adds metadata to this content, which is then accumulated in a metadata repository called a "referatory." Thus, the cross-institutional search system on JOCW content was realised. After the merger of NIME into OUJ, these services were taken over by CODE at OUJ. As of August 2010, 1,744 JOCW materials from 14 universities were registered in the referatory.

As numerous OER have been accumulated in repositories worldwide, some common platforms and strategies for collecting information and content are indispensable in order to find and retrieve quality content efficiently from scattered and distributed sources.

## GLOBE: A Federation of Metadata Repositories

To facilitate the international sharing and exchange of high-quality learning content, the core organisation in each country and region, which managed the functions for federated repositories and meta-repository, established the “Global Learning Objects Brokered Exchange (GLOBE)” consortium in September 2004. The original members were:

- ARIADNE (EU)
- education.au limited (Australia)
- eduSource Canada (Canada; McGreal et al. 2004)
- MERLOT (North America)
- National Institute of Multimedia Education (NIME, Japan)

Currently, the number of GLOBE members is 14:

February 2006	<ul style="list-style-type: none"><li>• eduSource Canada was replaced with LORNET</li></ul>
April 2009	<ul style="list-style-type: none"><li>• NIME was merged into the Open University of Japan as Center of ICT and Distance Education (OUJ-CODE)</li></ul>
March 2010	<ul style="list-style-type: none"><li>• education.au limited was merged into Education Services Australia</li></ul>
2007	<p>Joined GLOBE:</p> <ul style="list-style-type: none"><li>• Korea Educational Research and Information Services (KERIS, Korea)</li><li>• European Schoolnet (EU)</li><li>• Center for Open Sustainable Learning</li><li>• Utah State University (COSL, USA)</li><li>• Latin-American Community of Learning Objects (LACLO, Latin America)</li></ul>
2008	<p>Joined GLOBE:</p> <ul style="list-style-type: none"><li>• Institute for Information Industry (III, Taiwan)</li><li>• Institute for the Study of Knowledge Management in Education (ISKME, USA)</li></ul>
2009	<p>Joined GLOBE:</p> <ul style="list-style-type: none"><li>• Thailand Cyber University Project under the Higher Education Commission (TCU, Thailand)</li></ul>
2010	<p>Joined GLOBE:</p> <ul style="list-style-type: none"><li>• Inter-University Center for eLearning (MEITAL, Israel)</li><li>• Eummena Organization and Al-Quds University (Arabic countries)</li><li>• OER Africa (African countries)</li></ul>

See Appendix 11.1 for a full list of GLOBE members as of November 2011.

One of GLOBE’s objectives is to assure the quality of the cross-institutional searches by sharing the metadata, which GLOBE members have collected (Yamada and Morimoto 2010). Several GLOBE members are also members of OCWC or have deep commitments to other OER movements.

## **Our Challenge: Development of a Repository for Open Reusable Materials**

In order to develop a new OER development and delivery model, OUJ produced a series of quality video materials which can be used in the development of both TV broadcasting programmes and online courseware. These materials were accumulated in a learning object-oriented content repository with metadata and shared through a global metadata-sharing organisation.

## The Content: Open Materials

OUJ developed a set of learning components on International Volunteer Studies, in collaboration with the International Society of Volunteer Studies in Japan (ISVS). In order to increase their reusability, most of the components are simple videos or photos, which can be used in modules of online courseware, as well as for classroom teaching.

This academic area focuses on the theoretical and practical research of volunteer activities in international frameworks. The society supported the concept of OER, and so most of the content is open under a Creative Commons licence.

Currently, about 1,350 movie clips have been developed with a typical duration of one to three minutes. Each clip is available in two MPEG-4 formats ( $720 \times 480$  and  $600 \times 440$ ) and two WMV formats ( $600 \times 440$  and  $300 \times 220$ ). One of the MPEG-4 formats has sufficient quality for broadcasting. At the opening, the author information, title and copyright are shown in Japanese and/or English (see Figure 11.1). In addition to the name of the copyright holder, the conditions for use are shown with the icons of the relevant Creative Commons licence and more detailed information if necessary.

Volunteers from the society also provided materials, which had previously been collected in their own fields and used in their classrooms. As the academic topic was still developing rapidly and the scholars had not established a standardised curriculum, the volunteers also contributed to creating a taxonomy and classifying the keywords.

Figure 11.1: The opening of a small video clip produced by Open University of Japan.



## Metadata

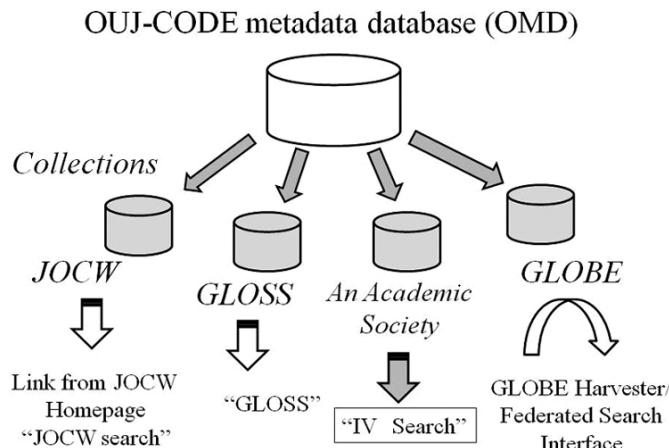
Each object in the OUJ repository is provided with metadata. While most of the metadata elements are based on IEEE LOM (IEEE 1484.12.1 - 2002 Standard for Learning Object Metadata), there are some exceptions. If the metadata element “Copyright” is used, for example (No. 19 in Appendix 11.2), the Creative Commons licence is described in the object vocabularies and the copyright

conditions are systematically shown in the search results. In addition, the metadata includes some elements for content management such as “Permission for Harvesting” and “Permission for Federated Searching.”

## The Metadata Database

OUJ manages a common metadata database (OUJ-CODE metadata database, OMD) with a relational database management system. By using different subsets of the metadata collections, we provide several search interfaces. One of them is JOCW Search. For the “International Volunteer Studies” materials, however, we prepared a new search interface, called “IV Search” (see Figure 11.2).

**Figure 11.2: Concept of the OUJ-CODE search system and “IV Search.”**



## Federation of Metadata Repositories on the GLOBE: GLOBE (Global Learning Object Brokered Exchange)

The OUJ metadata repository exchanges a part of the metadata with international partners through federated search and/or harvesting. For example, as a member of GLOBE, OUJ has provided the metadata to the GLOBE harvester in the harvesting system and returns query results in the federated search network. GLOBE has adopted the IEEE-LOM version 1.0 (IEEE 2002) for its metadata standard, the Simple Query Interface (SQI) (Simon et al. 2005) for the query language, and the Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH) (Logoze et al. 2002) for harvesting.

Using these standards, GLOBE has realised a global search and delivery network. The current numbers of harvested metadata are shown in Table 11.1. GLOBE users can find and retrieve high-quality learning content from the repositories, as well as provide their own content to potential users worldwide.

**Table 11.1: The total number of metadata collected by the GLOBE harvester, Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), as of February 2012**

*Note:* Other GLOBE members join using federated search technologies.

Source	Number
ARIADNE (EU)	513,703
European Schoolnet (EU)	185,940
LACLO (Latin America)	40,957
MERLOT (USA)	32,735
OER commons* (world)	30,903
KERIS (Korea)	7,439
LORNET (Canada)	2,295
OUJ-CODE** (Japan)	1,761
OER Africa (Africa)	1,703
<b>TOTAL:</b>	<b>817,436</b>

\* OER Commons is a project of the Institute for the Study of Knowledge Management in Education (ISKME).

\*\* The number for OUJ-CODE does not include materials from International Volunteer Studies.

## Prospects

### Business and Management Issues

At OUJ, the course materials are delivered mainly as a combination of printed textbooks and digital satellite/terrestrial broadcasting materials (TV or radio). The Internet is still a supplementary medium because many OUJ students have not prepared their own learning environments and lack the skills for online learning. As our students have different comfort zones in the learning environments, we consider OUJ should still keep multiple media content delivery.

Under the supervision of the lecturers, OUJ course materials are developed in each medium, while the processes, including copyright clearance, are independent. In order to reduce the cost while assuring the quality, restructuring of the development process in a more integrated fashion is needed. One of the major costs is for the copyright clearance of materials for broadcasting and Internet use. As OUJ has its own production department, it has started to digitise its own materials and to store them in a pilot component repository (that is, a “materials” repository) so that they can be shared and re-used in different contexts. However, the accumulation of materials progresses slowly due to limited financial and human resources. A “critical mass” of high-quality components can be achieved more quickly by sharing with other organisations and the OER community. This sharing will afford more comfortable circumstances for content assembly, adaptation and development.

## **Quality Assurance of Metadata and Content**

The quality of learning content and its metadata is a critical factor for sharing and distribution. Information on the quality of the content will be one of the basic and pressing value-added services of global search providers. One of the major differences between GLOBE search and other commercial search systems is that in GLOBE member organisations, only educators can register the metadata for their educational content. So, GLOBE search is considered to meet minimum standards for quality of educational content.

In addition, some GLOBE member organisations have their own quality assurance frameworks and standards. For example, MERLOT performs a peer review and recommendation system for higher education learning content. TELUQ (Télé-université du Québec) launched “the Quality for Reuse” project in collaboration with several Canadian universities and GLOBE. In this project, volunteers from ISVS classified the registered content based on their expertise. Results revealed new quality assurance processes through the collaborations within the academy.

The descriptions on shared metadata among GLOBE members are not absolute. They contain each member’s guidelines and the results of their evaluations, which could be different. In addition, in many cross-institutional search services, both selection of query results and display order depend on the local rules of the different members. In order to cope with the diversity of the users and their environments, it is important to have multiple viewpoints to ensure a reliable evaluation of the content. Allowing for differences ensures that the information on content quality provided by the different metadata is useful.

## **Technical Issues**

When sharing the many different OER, it should be more efficient to have some technical standards. As discussed above, repositories and their federations use various international standards. Examples include Dublin Core and IEEE-LOM for metadata, SQI for query language, and OAI-PMH for harvesting.

OUJ uses SCORM (Sharable Content Object Reference Model) for eLearning management and content development. SCORM supports the packaging of content using a collection of standards and specifications. Organisations and consortia with sufficient resources can implement SCORM in their development. However, individuals may have serious difficulties in doing the same. They need some tools for support in generating SCORM content or adequate guidance by experts. Metadata tagging is also considered to be a major roadblock even for organisations. Some automatic or semi-automatic tagging mechanisms are indispensable.

## **Conclusion**

When OUJ launched a cross-institutional search service on learning content in 2004, the primary concern was how to attain a “critical mass” of course materials. The initial search system focused mainly on the location of the searchable content. With the exponential increase in the number of digital learning resources and content repositories, distinctive value-added search functions

are becoming indispensable. There is a need to provide additional information and search services on rights management, quality assurance and education/pedagogical supports or recommendations, as well as customisations such as localisation and personalisation.

When we consider how to describe and share various pieces of information on new value-added services, standardised metadata is still one of the best solutions. In order to launch actual services among related organisations promptly, a framework for shaping agreements on the specifications of metadata elements and controlled vocabularies is indispensable.

With the progress of the digital exchange of educational content, new types of players who are specialised in specific functions can participate. In Japan, the Accreditation Council for Practical Abilities (ACPA) has started evaluation activities. ACPA is a non-profit organisation established in 2003 with the support of the government, corporations and higher education institutions. In order to assure the quality of practical learning resources and to promote the exchange between universities and corporations specifically, ACPA defines the practical abilities of several professional fields, develops the standard skill matrix in each field, and performs certification and accreditation of courses, course providers, educational institutions, lecturers and trainees based on their original or standardised criteria. The standard skill matrices are open to the public (ICT domain: [www.acpa.jp/en/acpa/standard\\_skill\\_matrix\\_bmd.pdf](http://www.acpa.jp/en/acpa/standard_skill_matrix_bmd.pdf)).

By re-using their evaluation results, we can add quality information in our metadata system. (For example, the category field of “Quality” element in our metadata system shows the name of the evaluating organisation and its standards; and the value field shows the result of the evaluation.) By sharing the metadata framework with new players in the digital exchanges, we can provide the right content to each learner more precisely and efficiently.

Sharing at the courseware level and at the component or module level is important to efficiently and effectively support localisation or personalisation of the content. In the re-use and remix, materials are often used in ways the original author never intended. Especially across borders, deployments in different cultural contexts can be pluralistic and unpredictable to the original creators. The propagation of component-oriented OER may depend on the tolerance of the original authors regarding the uncontrollability of their products. In the chain of educational content production, the providers have the roles of both authors and users simultaneously. One of the ways to support the further propagation of OER, therefore, is to respect the creator’s rights, while supporting the opening of knowledge for the benefit of all humanity.

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## Appendix 11.1: GLOBE member organisations, as of November 2011

Name of organisation/URL	Country	Date of participation	Notes
Al-Quds University <a href="http://www.alquds.edu/">www.alquds.edu/</a>	Palestine	2010/02	
ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe) <a href="http://www.riadne-eu.org/">www.riadne-eu.org/</a>	EU	2004/09	A founder
COSL (The Center for Open Sustainable Learning, Utah State University) <a href="http://cosl.usu.edu/">http://cosl.usu.edu/</a>	USA	2007/09	
education.au limited – EdNa Online	Australia	2004/09	A founder; closed in August 2009
Education Services Australia	Australia	2009/09	Successor of education.au limited
eduSource Canada	Canada	2004/09	A founder; closed in January 2006
EUN (European Schoolnet) <a href="http://www.europeanschoolnet.org/">www.europeanschoolnet.org/</a>	EU	2007/09	
III (Institute for Information Industry) <a href="http://www.iii.org.tw/english/">www.iii.org.tw/english/</a>	Taiwan	2008/04	
ISKME (Institute for the Study of Knowledge Management in Education) <a href="http://www.iskme.org/">www.iskme.org/</a>	USA	2008/09	
KERIS (Korea Educational Research and Information Services) <a href="http://english.keris.or.kr/">http://english.keris.or.kr/</a>	Korea	2007/02	
LACLO (Latin-American Community of Learning Objects) <a href="http://www.laclo.espol.edu.ec/">www.laclo.espol.edu.ec/</a>	Latin American countries	2007/09	
LORNET <a href="http://www.lornet.org/">www.lornet.org/</a>	Canada	2006/02	Successor of eduSource Canada
MERLOT (Multimedia Educational Resource for Learning and Online Teaching) <a href="http://www.merlot.org/">www.merlot.org/</a>	North America	2004/09	A founder
METAL-Inter-University Center for e-Learning (IUCEL) <a href="http://meital.iucc.ac.il/meital/English/English.htm">http://meital.iucc.ac.il/meital/English/English.htm</a>	Israel	2010/02	
NIME (National Institute of Multimedia Education)	Japan	2004/09	A founder; closed in March 2009
OER Africa <a href="http://www.erafrica.org/">www.erafrica.org/</a>	African countries	2010/09	
OUJ-CODE (Center of ICT and Distance Education, the Open University of Japan) <a href="http://www.code.ouj.ac.jp/">www.code.ouj.ac.jp/</a>	Japan	2009/04	Successor of NIME
TCU (Thailand Cyber University Project) <a href="http://www.thaicyberu.go.th/">www.thaicyberu.go.th/</a>	Thailand	2009/03	

## Appendix 11.2: Metadata elements used in OUJ-CODE common metadata database

No.	Name	Corresponding element to IEEE 1484.12.1-2002
1.	ID of the metadata	3.1 Meta-Metadata - Identifier
2.	ID of the LO <sup>a</sup>	1.1 General - Identifier
3.	Title	1.2 General - Title
4.	Language(s) used within the LO	1.3 General - Language
5.	Description	1.4 General - Description
6.	Keyword(s)	1.5 General - Keyword
7.	Aggregation level	1.8 General - Aggregation Level
8.	Contributor to the LO	2.3 Life Cycle - Contribute
9.	Language of the metadata	3.4 Meta-Metadata - Language
10.	MIME media types of the LO	4.1 Technical - Format
11.	URL	4.3 Technical - Location
12.	Technical requirements to use the LO	4.4 Technical - Requirement
13.	Educational stages <sup>b</sup>	5.6 Educational - Context
14.	Intended learning time	5.9 Educational - Typical Learning Time
15.	Intended user of the LO	5.10 Educational - Description
16.	Paid-for or free	6.1 Rights - Cost
17.	Restriction of usage	6.3 Rights - Description
18.	Classification <sup>c</sup>	9. Classification
19.	Copyright <sup>d</sup>	-
20.	Quality <sup>e</sup>	-
21.	Permission to Harvesting	(for GLOBE Harvesting)
22.	Permission to Federated Search	(for GLOBE Federated search)

a *ID of the LO* is generated automatically as Catalog is "URL"; Entry is the actual URL.

b *Educational stages* have a unique value space matched to the Japanese educational system.

c *Classification* shows the taxonomy system and its value(s).

d *Copyright* shows the rights management system and its value(s).

e *Quality* shows the quality assurance system and its value(s).

