

## 6

*This chapter looks at the development and nature of learning objects, meta-tagging standards and taxonomies, learning object repositories, learning object repository characteristics, and types of learning object repositories, with type examples.*

## Learning Object Repositories

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During the past few years, a new way of thinking, object-oriented thinking, has spawned the creation of small, reusable educational chunks of digital information that educators and trainers can archive and use in their course building and also share with others. Archiving and sharing eliminates the need to recreate what has already been produced, stimulates collaboration and ingenuity, and can provide rich support for learning. This thinking and creating are increasingly taking hold across the social sector in education, government, and business. These digital chunks of information take on many forms: text, video, audio, graphics, and multimedia and include tutorials, scenarios, simulations, lesson modules, case studies, and assessments. The accepted term for these small units of learning is learning objects. To enable their accessibility, reusability, generativity, shareability, durability, and scalability, meta-tagging standards and learning object repositories are evolving.

### A Closer Look at Learning Objects

More than thirty years ago, Gerard (2006) suggested that curriculum units in computer-based instruction could be made smaller and combined in various ways for customization and use by individual learners. Learning objects are an application of this type of object-oriented thinking, and during the past few years, they have drawn the attention of education, government, and business. Multiple definitions have evolved to describe learning objects. The definition that is now most widely accepted is that of Wiley (2000): “any digital resource that can be reused to support learning” (p. 7) and can be used in multiple contexts.

Wiley (2000) has also created a taxonomy that specifies different kinds of learning objects. The types are differentiated by “the manner in which the object to be classified exhibits certain characteristics” (p. 22). These characteristics apply across environments and include the number of combined elements, categories of objects contained, reusable components, common functions, extra-object dependence, type of log-in contained in the object, and the potential for both inter- and intracontextual reuse. Additional descriptions of learning objects incorporate six key characteristics: accessibility, interoperability, adaptability, reusability, durability, and granularity (“Learning Object Authoring Zone Networks,” 2004).

Shepherd (2006) views learning objects as serving a variety of purposes and suggests three types, as shown in Table 6.1: integrated, informational, and practice and review. For example, an instructor could develop a physics simulation that would include supportive information (integrated), create a descriptive instructional design model (informational), or create a course review exercise (practice and review).

**Learning Objects: Meta-Tagging Standards and Taxonomies**

The use of learning objects necessitates employing meta-tags for ease of search, retrieval, and use. Meta-tagging is “data about data” and needs to be thoughtfully determined and selected by instructors and instructional

**Table 6.1. Objects of Interest**

<i>Types of Learning Objects</i>		
<i>Integrated</i>	<i>Informational</i>	<i>Practice and Review</i>
Mini-Tutorials	Overviews/summaries	Problems/case studies
Mini case studies, simulations, etc., with supportive information	Descriptions/definitions	Games/simulations
	Demonstrations/models	Drill-and-practice exercises
	Worked examples	Review exercises
	Cases/stories	Tests/assessments
	Papers/articles	
	Decision aids	

Source: Shepherd (2006).

designers and applied to the learning objects. These tags describe the content, their origin, form, applicability, and other significant characteristics.

Applying meta-tags to learning objects is the process of adding appropriate descriptions and values to the elements of the digital resources. The tags selected should match the main subject of the resource. The process used is to (1) decide what the resource is about, (2) select the appropriate terms that will help identify the resource, (3) enter the terms, and (4) make a final check of the tags. Appropriate tagging enables accessibility, interoperability, adaptability, reusability, durability, and scalability.

Both standards and taxonomies are critical to the development of meta-tags. Standards allow for interoperation, while taxonomies order, classify, and group according to presumed natural relationships, thus providing frameworks for discussion, analysis, or the retrieval of information. To facilitate the global adoption of learning object standards and taxonomies, a number of initiatives have emerged. The Dublin Core Metadata Initiative (2006) was created in 1995 to provide simple standards that would facilitate the finding, sharing, and management of information through describing resources, supporting a worldwide community of users and developers, and promoting widespread use of its solutions. The Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE) was formed in 1996 ("ADL Background," 2006), and the Instructional Management Systems Project (2006) was developed several years later.

In 1997, the Department of Defense Advanced Distributed Learning (ADL) initiative was begun. Two years later, the first version of the Sharable Courseware Object Reference Model (SCORM) was drafted as the result of a perceived confusion and lack of coordination on the part of the earlier initiatives. The ADL SCORM focus became the integration and connection of the work of the other initiatives. In this effort, an attempt was made to adapt the Computer Managed Instruction model to the Internet, resulting in a Web-based communications model. ADL also worked closely with the IEEE and the Institute of Mathematical Statistics (IMS) to stabilize the metadata specification and create an XML binding. Later, ADL was able to realize an integration of the Aviation Industry CBT (Computer-Based Training) Committee (AICC) and IMS. This resulted in the IMS's content packaging specifications, which provide the functionality to describe and package learning materials, such as an individual course or a collection of courses into interoperable, distributable packages. Content packaging addresses the description, structure, and location of online learning materials and the definition of some particular content types ("Cover Pages by Oasis," 2006). AICC and IMS are now included in SCORM ("ADL Background," 2006).

An important aspect of using the learning objects is the organization, design, and search capabilities of the learning object in a specific format. For example, in the case of an American Sign Language (ASL) course (Con-

ceição and Lehman, 2002), video-based learning objects were arranged in units and in categories that paralleled the course sequence. They were used for review and practice by the course learners. This arrangement was based on the instructional design of the course by the instructor and instructional designers. In other cases, learning objects may be organized differently, for example, around modules, themes, scenarios, critical incidents, or case studies. The use of search features helps users locate a specific topic, phrase, word, video, or graphic precisely when needed. A direct link to the learning object can also be incorporated. At London Metropolitan University, learning objects were used within online modules. The learning objects were created to help explain the complex aspects of Java programming. Text was complemented with multimedia to engage students visually. These learning objects were then integrated into course modules within the school's learning management system and introduced to the students for optional use. The learning objects were accessible using a direct link within the module (Bradley and Boyle, 2004).

With an increase in the number of learning objects being created and the development and refinement of meta-tagging standards and taxonomies, database-driven electronic spaces for accommodating the learning objects for retrieval and sharing have become necessary. The term used for these dynamic spaces is repositories.

## **Knowledge Repositories**

Libraries and course management systems are considered knowledge repositories for large categories of information and course content. They have dealt mainly with archiving or the containing of information. Distinct access characteristics are usually required, as well as different log-ins. These knowledge repositories are structured in a variety of ways, making it difficult to exchange content in a flexible manner. In addition, they are conceived and designed as stand-alone systems instead of parts of a more cohesive resource of information. With the creation of smaller units for learning, that is, learning objects, the need for a different type of repository has emerged: learning object repositories.

## **Learning Object Repositories**

Learning object repositories use well-researched user interfaces and architectures that make them easy to use, and they allow various levels of interactivity (Instructional Resource Center, 2006). Because the field of repositories is in its infancy, repository types and characteristics are only now beginning to be defined.

A learning object repository is an electronic database that accommodates a collection of small units of educational information or activities that

can be accessed for retrieval and use. Learning object repositories enable the organization of learning objects, improve efficiencies, enhance learning object reuse and collaboration, and support learning opportunities. Repositories can consist of one database or several databases tied together by a common search engine. Organizations that operate digital repositories take on responsibility for the long-term maintenance of these digital resources, as well as for making the repositories available to communities agreed on by the depositor and the repository (“British Library,” 2006).

One way of looking at learning object repositories is to divide them into three types: general, discipline specific, and commercial (“Learning Objects: Collections,” 2003). Important factors to be taken into consideration when selecting the type of repository that will be most valuable is to look first at type match and then at the accessibility, flexibility, and usability for the end users: instructors, instructional designers, and learners.

### **Characteristics of Learning Object Repositories**

As faculty interest in searching for preproduced case studies, out-of-class assignments, lab demonstrations, and extra credit work increases, the list of places vying to provide a home for learning objects is growing and providing users with an expanding number of choices (Long, 2004). In addition, projects and institutions are beginning to create their own customized repositories.

The successful selection or creation of a learning object repository depends on the specific characteristics that meet the needs of instructors, designers, and learners. Needs are the first and most important characteristic in this selection. Learning objects should be able to be easily accessed at the exact moment that the design need or learning activity calls for it. Content compatibility is another critical characteristic. Repositories created for specific topic areas or disciplines should be matched with that content. Other characteristics include the ease of the repository for sharing information with others, the capacity for collaboration, the capability for reuse of the learning objects, context sensitivity, coding and retrieval, editing, combining, and repurposing. Finally, there is the ease of accessibility for instructors and learners with diverse and special needs.

With the creation of learning objects and learning object repositories comes the need for answering the many questions that surface concerning digital rights and policy.

### **Learning Objects and Repositories: Digital Rights and Policy**

When the Copyright Amendment Digital Agenda Act of 2000 came into effect, printed rights were broadened to include digital rights. These rights promote creative endeavors while allowing reasonable access to copyright material.

They include the right to make materials available online, as well as the right to transmit works electronically. It is important to know that rights are not limited to a specific technology.

Digital rights have a heavy impact on the academic world and other types of education and training. Educational and training institutions need to manage their use of intellectual property to ensure they are complying with the law. As a result of the new Digital Agenda reforms, educational organizations must become far more vigilant about ways in which teaching staff use and manage protected intellectual property. All teachers and educational managers need to recognize they have an obligation to understand the implications of their work in relation to using the copyright-protected materials of other persons (Australian Flexible Learning Framework, 2006).

Digital rights management (DRM) standardization is now occurring in a number of open organizations. The solutions to these challenges will enable large amounts of new content to be made available in open, safe, and trusted environments. Industry and users are now demanding that standards be developed to allow interoperability. By doing this, content owners and managers would not be forced to encode their works in proprietary formats or systems. DRM architecture is fundamental to interoperability and openness. It includes Internet protocol (IP) asset creation capture (rights validation, creation, and work flow), IP asset management (repository, content and metadata, trading, payments, and packaging), and IP asset use (permission and tracking) (Iannella, 2001).

## **Learning Object Repositories: Some Lists and Examples**

One way to look at learning object repositories is to divide them into three types: general, discipline specific, and commercial ("Learning Objects Repositories," 2006). A number of lists and charts have been developed that include repositories of these types. Among them are the "Academic ADL Directory of Learning Object Repositories Listing" (2006), the "Learning Object Collections" (2006), and the "Learning Objects Repositories" (2006).

**General Repositories.** Following are examples of general learning object repositories:

- CLOE: Cooperative Learning Object Exchange, <http://cloe.on.ca/>. CLOE was founded at the University of Waterloo and currently consists of seventeen university partners in Ontario. Of significance is that CLOE attempts to foster a collaborative model for the development, use, and reuse of learning objects. Fundamental to this is the creation of a virtual market economy whereby virtual credits are awarded for objects that are

used and reused the most. Those who wish to use the services of CLOE must register.

- European Knowledge Pool System (ARIADNE), <http://www.ariadne-eu.org/>. ARIADNE is a European association open to the world for the sharing of knowledge and its reuse. It was developed to deliver educational content throughout Europe and facilitate the sharing and reuse of educational resources. This encouragement of the discovery and reuse of these materials promotes an increasing recognition that learning object production is a valid field of activity for academics. The collection contains materials of a wide variety of interactivity levels in many European languages, primarily English, French, Italian, German, and Dutch. ARIADNE has four levels of access: (1) open to everyone through a default account, (2) members only, (3) registered users of the server on which the material was uploaded, and (4) only after contact with the rights holder.

- Wisconsin Online Resource Center Wisc-Online Learning Object Project, <http://www.wisc-online.com/>. Wisc-Online is an international award-winning learning object repository that contains over two thousand learning objects, with new ones continuously under development. Although it was developed primarily by faculty from the Wisconsin Technical College System (WTCS), produced by multimedia technicians, and made available at no cost and with copyright clearance for use in any WTCS classroom or online application, it can be used by other colleges, universities, and consortia around the world, with permission. Users click to sign on and receive a password. Current use of the learning object repository exceeds twenty thousand hits per day. The process used to develop the learning object repository is described in Chitwood, May, Bunnow, and Langan (2000).

- Multimedia Educational Resource for Learning and Online Teaching (MERLOT), <http://www.merlot.org/Home.po>. MERLOT is often referred to as both a repository and “referatory.” It is a free and open resource designed primarily for faculty and students of higher education. Links to online learning materials are collected here, along with annotations such as peer reviews and assignments. The MERLOT community is made up of individual members, higher education, institutions, and corporate partners and affiliates dedicated to improving education. Individual MERLOT members support the community by contributing materials and adding assignments and comments to the MERLOT collection. MERLOT partners contribute infrastructure, guidance, and expertise.

**Discipline Specific.** Following are examples of discipline-specific learning object repositories:

- Global Education Online Depository and Exchange (GEODE), <http://www.uw-igs.org/>. This repository provides networking, funding, and developmental opportunities to University of Wisconsin campuses interested in increasing interdisciplinary cooperation and scholarship around

global issues. It was created in 1999 in response to the commissioned Wisconsin International Trade Council's Report that identified a need for greater international literacy among members of the Wisconsin workforce. The repository is maintained by the University of Wisconsin System's Institute for Global Studies and permits queries by country, region, file format, language, or keyword. No registration is required for this repository.

- Health Education Assets Library (HEAL), <http://www.healcentral.org>. Conceived in 1998 and having begun its collection development in 2002, this repository provides building-block multimedia items (images, videos, and animations), as well as textual materials like case studies and quizzes. Its current prototype collection of over a thousand materials contains resources useful to medical students and medical professionals. The collection will eventually contain materials of use to all educational levels. It currently contains images and interactive tutorials. This site is freely accessible to everyone. Registration is not necessary.

- Math Forum, <http://mathforum.org>. One of the oldest collections of learning materials on the Internet, the Math Forum is a leading electronic center for mathematics and mathematics education. The Math Forum is a learning repository for both interactive and text-based materials, as well as a site for mathematics educators and learners to engage in person-to-person interactions and discuss and exchange educational products and services. The Math Forum encourages the exchange of educational materials by facilitating dialogue and connections among educators. This repository is freely searchable but also offers math problem packages for purchase.

- American Sign Language, <http://www.uwex.edu/ics/learningobjects/>. This customized repository is password-protected, along with the need to e-mail the owners for purposes of tracking. The repository is part of a University of Wisconsin-Milwaukee and University of Wisconsin-Extension American Sign Language (ASL) Learning Objects Project. This repository contains video-based ASL learning objects, in individual words and phrases, performed by a native ASL speaker. These video-based learning objects have been created in a variety of delivery formats. They are currently being tested for effectiveness of use on CD-ROMs in ASL classes. Their use is also being tested on handheld computers and in this knowledge repository. It is recommended that these ASL video-based learning objects be used as an instructional aid in combination with an ASL program or course. RealPlayer is needed to play the videos (Conceição and Lehman, 2002). The learning objects for the knowledge repository have been meta-tagged for SCORM compliance and recategorized for easy access by the general public. The opening page of the repository provides an example of a learning object to introduce the users to the format of the individual signs. It then directs users to the appropriate signs.



**Commercial/Hybrid.** Following is an example of commercial/hybrid learning object repositories:

- XanEdu, <http://xanedu.com/>. XanEdu provides faculty with the resources necessary for gathering and delivering information and provides instructors and instructional designers. Other trends must include increased repository sustainability, better funding, more clearly stated educational goals for repository infrastructure, an expanding number of repositories that will eventually reach a critical mass, instructor and learner repository orientation, and instructor and learner training for the more sophisticated creation and use of learning objects and learning object repositories.

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