Designing Learning Objects for Online Learning

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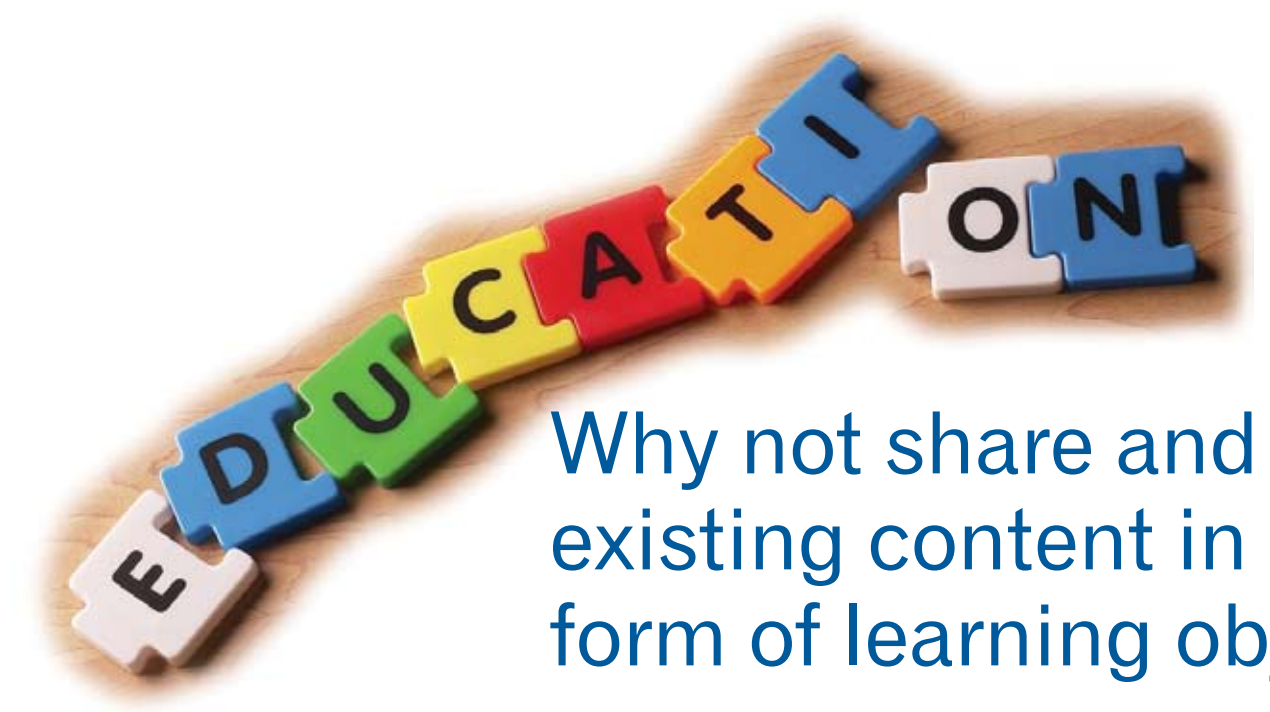
A TOPICAL, START-UP GUIDE TO DISTANCE EDUCATION PRACTICE AND DELIVERY



Why not share and reuse existing content in the form of learning objects?

INSTRUCTIONAL DEVELOPERS ARE KNOWLEDGE WORKERS

As knowledge workers, faculty, instructors and instructional developers seek tools to benefit their work lives and improve their students' academic experiences. Instructors everywhere draw upon knowledge of their discipline to fashion course and lesson materials. Most often they use resources from text books, lecture notes or media from institutional and personal collections.

An area of increasing improvements and efficiencies is the use of technology-based tools to create, deliver and support learning. As the process of producing digital media becomes more accessible and affordable, the notion of creating, sharing, and reusing digital objects and artifacts has become more mainstream. Increasingly, instructors use computers, scanners, digital cameras, graphic files, and other digital media tools and materials to build personal digital collections of instructional resources that they can reuse and re-engineer to suit their students' learning needs, to adapt to new knowledge in their discipline area, or to address new experiences that their students bring to class.

INTRODUCTION TO LEARNING OBJECTS

The phrase "learning object" (LO) comes from the idea of object-oriented programming, where parts of computer code are reused for various software applications. This concept was transferred to re-purposing content for different learning situations.

Traditionally, open and distance-learning (ODL) content is designed as a large course that does not lend itself to potential reuse. But with a LO approach, content is designed as smaller units of learning that support potential reuse, that can stand alone, and that can be made accessible to meet the "just enough" and "just-in-time" requirements of learners.

As developing quality content for ODL can be very expensive, time consuming and require specific expertise, why not share and reuse existing content in the form of LOs?

DEFINING LOs

In 2006, the Institute of Electrical and Electronics Engineers (IEEE) quality assurance and standards body defined LOs as "any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning."

A learning object is:

- A chunk of content structured to support learning through the possible inclusion of educational objectives, content, resources, activities and assessment.
- Content designed to ensure reuse within different instructional settings.
- Content that can be stored within different digital learning management systems (LMS), or used in many different delivery modes.

A learning object is not:

- A piece of text, or a graphic, or a video clip. These are resources which support a LO and are often used to create LOs.
- An entire course on a particular topic.

Educational organisations that implement a LO approach often come up with internal definitions that link various LOs into a cohesive learning experience. This "common language" is beneficial when working within a large organisation or with other team members. For example, Cornell University in the United States uses Ulises A. Mejias' "learning molecules model" for categorising LOs by their instructional uses:

- Scenario (e.g. a question, a problem or a case study)
- Resources (e.g. an article or an image)
- Utility (e.g. a simulation or a calculator)
- Collaboration (e.g. a discussion board or an email)
- Evaluation (e.g. a test, an activity or an exercise).

How do LOs function? LOs should be:

Accessible: LOs should be tagged with descriptive information or "metadata" so that they can be stored and referenced in a digital database or learning object repository (LOR), to be easily searched for and retrieved by educators and learners.

Reusable: Once created, LOs should function in different instructional contexts.

Interoperable: LOs should be independent of both the delivery media and knowledge management systems so they can be used and transferred seamlessly between different technologies and institutions.

DESIGNIN

BENEFITS OF LOs

Professional: Faculty and instructors benefit from creating and sharing peer-reviewed LOs with colleagues in their disciplines.

Developmental: Systematic review, revision and sharing of LOs fosters instructional development and can significantly contribute to learner experience.

Organisational: Sharing learning resources across institutional boundaries helps avoid duplication of effort when designing courses that share common learning outcomes.

MANAGING LOs

There is currently (as of 2007) no commonly accepted, simple and effective format for legally sharing, reusing and managing academic learning resources between academics in multiple institutions and across the Internet.

Schemes for learning resource use and reuse, and the digital rights management resulting from reuse, include:

- Pay-per-use models from publishing concerns, such as CAPDM Limited based in the United Kingdom
- Peer-reviewed libraries with both royalty and non-royalty mechanisms, such as the Multimedia Educational Resource for Learning and Online Teaching (MERLOT) based in the U.S.
- Freely usable collections of online objects created specifically to enable sharing and reuse between academics, such as the Rice University Connexions Project and the Massachusetts Institute of Technology's Open CourseWare Project (MIT OCI), both based in the U.S.

In many jurisdictions worldwide, projects have been initiated to create networked libraries of digital resources, as well as the related tools and processes to develop, deliver and support courses. In Canada, the largest of these projects was a $9 million CDN, pan-Canadian initiative in which researchers from public institutions and private corporations built a technical interoperability framework, instructional design tools, metadata tools and digital rights management tools for creating and managing shareable learning resources. The case studies at the end of this guide provide some working examples.

COPYRIGHT AND LICENSING

CREATIVE COMMONS

The Creative Commons digital copyright and licensing model from law researchers at the Stanford University Law School in the U.S., is a digital rights management mechanism for sharing and reusing learning resources or other creative work.

Creative Commons provides its users with a set of licenses from which to choose, each consisting of a "human-readable deed," a lawyer-readable copyright and license agreement, and machine-readable digital code, written in extensible markup language (XML). The machine-readable digital code mechanism applies a copyright and license graphic to the web page on which a learning resource appears. The machine-readable code also travels with the resource as metadata in a digital format that conforms to the resource description framework (RDF) specification of the World Wide Web Consortium (W3C) which creates and publishes Web standards and guidelines. This consortium has worked on issues related to searching for and retrieving LOs. The W3C also engages in education and outreach, develops software and operates as an open forum for discussion about the Web.

Creative Commons is based on the Open Source Software (OSS) community's approach to resource sharing, where the original copyright of a work (usually software code) is held by a developer who freely licenses the code to other developers, on the condition that all ongoing improvements and derivations of the code are made available to the wider "community of interest" in perpetuity.

This approach was a partial response to the actions of many software companies and entrepreneurs that reserve all rights for themselves and restrict access to the original software code, sometimes leaving users stranded when the company folds or no longer supports the software.

The OSS community uses SourceForge.net as a common location to house information and code releases for ongoing open source development projects. More open source concepts, license models and information can be found at the Open Source Initiative (OSI) website.

Another approach to making shared instructional resources available across continents using open source-like models is the Massachusetts Institute of Technology (MIT) Open Courseware Initiative, which makes self-study materials from MIT freely available to students anywhere in the world. The project uses Creative Commons as its primary resource licensing mechanism.

BC COMMONS

BCcampus, a collaborative initiative of the Ministry of Advanced Education (AVED) and 26 public post-secondary institutions in British Columbia (BC), Canada, uses a model similar to Creative Commons.

FIGURE

The BCcampus management team of senior educators and technical developers created a single "point of presence" Web-based learning portal that provides BC learners and educators with academic and student support services.

BCcampus learners can find online information about BC institutions; apply for admission; register for courses; audit their prior learning and credentials against programs they wish to take; obtain counseling and financial aid services; access online library services; and take courses.

BCcampus educators are part of an online community of practice in which they can find best practices information; courseware development grants; and a LOR. All course developers funded through the BCcampus online program development fund (OPDF) initiative must sign a sharing and reuse license agreement based on either Creative Commons, or a geographically-based license that allows reuse and re-engineering only to educators within BC.

FIGURE

The BCCampus LOR has a friendly user interface that clearly communicates its purpose to educators, and signals use of both the Creative Commons and BC Commons license models *[Figure 1]*. Each learning object in the BC Commons SOL*R repository is clearly tagged with a license that describes it reuse and re-engineering rights to end-users.

A typical BC Commons license deed *[Figure 2]* clearly shows instructors, or anyone interested in using a LO or resource licensed in this way, their rights of usage.

In the case shown, instructors can reuse or re-engineer the resource provided that any improvements to the resource must be put back into the repository for others' benefit.

Author attribution is also required by all licenses of this sort, consistent with the expectations and professional ethics observed by academics in similar situations where other works are cited.

IG LEARNIN

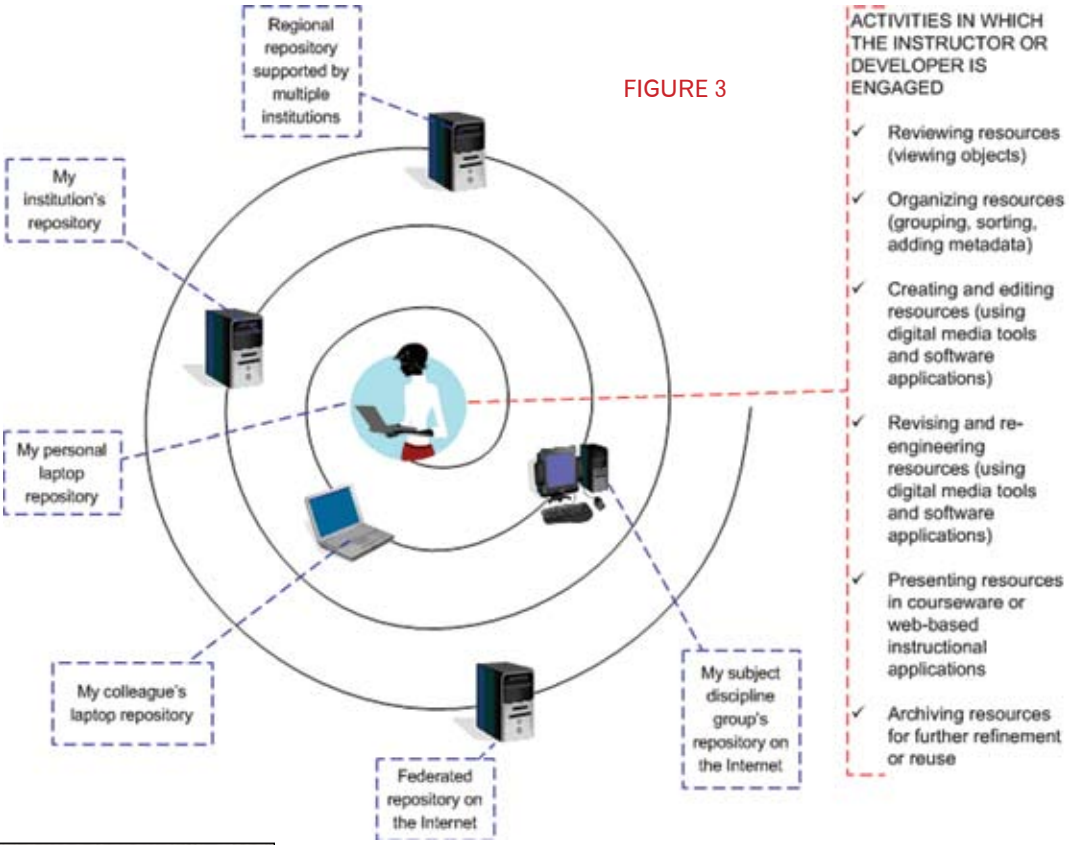


FIGURE 3

DESIGNING LOs: KEY CONSIDERATIONS

Basic instructional design principles apply to designing effective LOs that reflect the needed qualities of educational integrity, reusability, accessibility and interoperability, and that meet learner needs *[Figure 3]*.

Some considerations:

Do you have a specific learning objective to support by developing a LO, such as a historical concept *[Figure 4]* or mathematical problem? What skills and knowledge do you anticipate learners to gain from your LO?

FIGURE 4

Is developing a LO more effective than using other existing or readily available resources to meet your educational objective?

Who are the learners who will be using the LO? What is their approximate age, technical skill level and motivation?

How will the LO be used? How will learners use your LO to meet the educational objective? How will content be presented, for example, through a problem-based approach or by introducing different scenarios? How will the LO relate to other resources being used? Build on a learner's existing knowledge and try to use real-life, concrete examples where possible to help learners understand a concept more easily. For example, if your LO is about a scientific concept, demonstrate this concept through examples that are relevant or meaningful to the learners. Introduce complex scenarios or problem-based learning to promote thoughts and opinions, instead of simpler question-answer techniques such as "True or False" or multiple choice. These strategies are appropriate in some contexts, but tend to focus on rote memorisation of facts.

Are you using different media in your LO, such as a combination of text, graphics and audio? Designing your LO using a variety of media will help engage learners, promote interactivity and reinforce concepts. Introduce a variety of activities that engage learners and promote deeper learning such as problem solving, analysing, drawing conclusions or comparing opinions.

What rights issues might there be? Do you have permission to use an image or a piece of text? Are you creating original content or adapting from a third party source?

What resources are available for development, such as access to expert course designers, multimedia personnel and financial support?

How will learners evaluate their progress? Provide opportunities for learners to assess their learning through interactive activities that provide constructive feedback; for example, a given answer should not be just "right" or "wrong," but should also explain why.

COMMON ELEMENTS

When designing a comprehensive course for ODL with a number of different units, think about generic content or skills that recur within the course. For example, generic content for a course on language skills may include grammar, writing techniques, spelling and pronunciation. These common skills could be presented in a LO approach and potentially reused for other learning situations, such as business communication, language arts and technical communication. Other content that lends itself to reuse as a LO more than others include scientific techniques, information technology skills, and problem-solving and decision-making skills.

ANYTIME, ANYWHERE

The less context integrated into a LO, the more potential for reuse within different learning situations. For example, a video clip, an image or an audio piece can be reused more so than a complete course or module. However, as a LO should reflect an educational objective, it should be self-contained with specifically designed activities and assessment methods to meet the educational objective. Also, try not to reference specific sections of the course you intend to use the LO for (e.g. "in Section 2 you learned about lab safety"), but rather refer to topics in more general terms (e.g. "you have just learned about lab safety").

DESIGNING AND IMPLEMENTING LOs: KEY CHALLENGES

There are a few lingering issues that need further development before a LO culture becomes more firmly established in academic circles.

A culture of reuse: Investment in repository tools, training, and legislative support by institutions or governments will not succeed unless you and your colleagues can see the value in reusing and re-engineering instructional content.

G OBJECTS

Technical expertise: Although learning objects can be defined as digital or non-digital, many examples are digitally based and are highly interactive, effectively incorporating audio, images and text. Designing high-end multimedia-based LOs requires specific, and at times complex, technical skills in using specific software applications, such as the Macromedia Dreamweaver Web development tool. However, new tools are constantly being developed that require less technical proficiency.

Educational design: A learning object will not effectively promote learning unless basic instructional design principles are applied. Sometimes the novelty of the technology becomes the focus through incorporating a series of flashy multimedia features, without adequately considering the educational objective or providing mentally stimulating activities and assessment opportunities.

Intellectual property (IP) and copyright issues: Institutions wanting to form their own LORs must have a clear and legal reuse licensing policy, either in the form of an international model such as Creative Commons or localised models such as BC Commons.

Quality assurance and design standards: Address quality assurance and design standards through voluntary peer review or mandatory systemic review initiatives. This is increasingly important, as more and more instructional media and content become available for reuse internationally.

CASE STUDIES

THE LE@RNING FEDERATION (TLF), AUSTRALIA

In 2001, the state, territory and federal governments of Australia and New Zealand funded the launch of The Le@rning Federation (TLF) initiative, which provides free access to online LOs for all kindergarten to Grade 12 teachers and learners, and Australia's Distance Learning Schools. TLF provides more than 4,000 interactive LOs in science; math; literacy; Australian studies; languages; and innovation, enterprise and creativity. Through specific design and development criteria, TLF ensures that the LOs are based on educational soundness, copyright standards, and technical standards that reflect interoperability, flexibility and access for teachers and students. The online LOs are currently only accessible to teachers and learners in Australia and New Zealand, although the LOs themselves are designed for online and offline use. The main TLF website *[Figure 5]* provides LO examples and documents about their quality standards.

FIGURE 5

CLOE, UNIVERSITY OF WATERLOO, CANADA

The Co-operative Learnware Object Exchange (CLOE) *[Figure 6]* is a collaborative project of 16 universities and colleges in Ontario, Canada to jointly develop interactive LOs. This project also has agreements with organisations in other parts of Canada and with Thailand. Post-secondary institutions can share over 100 peer-reviewed LOs within a community-focused environment that includes faculty, instructional designers and other staff who ensure that LOs are developed to high standards and support effective learning.

FIGURE 6

JORUM REPOSITORY, U.K.

In 2005, the Joint Information Systems Committee (JISC) created the JORUM repository service *[Figure 7]* for post-secondary institutions in the U.K. The JORUM repository contains online resources in the form of LOs and other digital resources, such as documents, images and diagrams. U.K.-based education teaching and support staff register with JORUM to freely access this service. The provided LOs and resources are multi-disciplinary and cross-sectoral, and can be used within a face-to-face classroom situation or a blended model where aspects of ODL are integrated with face-to-face components. Users locate resources and LOs, and download or upload and share their own resources and LOs. The goal is to encourage the sharing and reuse of existing materials between post-secondary institutions, which allows teaching staff more time to support students.

FIGURE 7

LIONSHARE, U.S.

LionShare *[Figure 8]* is a networking project that allows educators from around the world to securely share digital resources based on Open Source technologies. This project is a collaborative effort between Penn State University and the MIT Open Knowledge Initiative in the U.S., researchers at Simon Fraser University in Canada, and the Internet2 P2P Working Group. The rationale is to increase the wider accessibility of academic digital resource collections "hidden" within various post-secondary institutions. Users access content stored in networks of LORs around the world, upload and share digital resources, and search and retrieve existing resources for potential reuse.

FIGURE 8

GLOSSARY

DIGITAL REPOSITORY: A TECHNICAL INFRASTRUCTURE TO STORE, MANAGE AND REUSE DIGITAL MATERIALS.

EXTENSIBLE MARKUP LANGUAGE (XML): A WORLD WIDE WEB CONSORTIUM-RECOMMENDED, FREELY AVAILABLE, EASY AND SECURE GENERAL PURPOSE MARKUP LANGUAGE FOR DATA TRANSFER, DATA STORAGE AND DATA MANIPULATION. ITS MAIN PURPOSE IS TO FACILITATE DATA SHARING ACROSS DIFFERENT SYSTEMS, PARTICULARLY VIA THE INTERNET. IT IS INDEPENDENT OF VENDOR, PLATFORM AND APPLICATIONS.

INTEROPERABILITY: THE ABILITY OF HARDWARE OR SOFTWARE COMPONENTS TO WORK TOGETHER EFFECTIVELY.

METADATA: INFORMATION THAT IDENTIFIES THE CONTENT OF A WEB PAGE OR DIGITAL RESOURCE THAT ENABLES IT TO BE STORED IN AND RETRIEVED FROM A DIGITAL DATABASE.

OBJECT ORIENTED PROGRAMMING (OOP): A SPECIALISED APPROACH TO COMPUTER PROGRAMMING THAT COMBINES DATA STRUCTURES (A WAY TO ORGANISE RELATED PIECES OF INFORMATION ELECTRONICALLY, SUCH AS FILES, RECORDS AND TABLES) WITH FUNCTIONS, TO CREATE REUSABLE OBJECTS THAT ARE EASIER TO MODIFY.

RESOURCE DESCRIPTION FRAMEWORK (RDF): AN RDF CONTAINS INFORMATION ABOUT THE INFORMATION ON THE WEBSITE, OR ITS METADATA—SUCH AS A MAP OF THE SITE, THE DATES WHEN UPDATES WERE MADE, KEYWORDS THAT SEARCH ENGINES LOOK FOR AND THE WEB PAGE'S INTELLECTUAL PROPERTY RIGHTS. DEVELOPED BY THE WORLD WIDE WEB CONSORTIUM TO ALLOW USERS TO MORE EASILY SHARE WEBSITE INFORMATION.

SOFTWARE CODE: COMPUTER SOFTWARE USES CODE TO CREATE VARIOUS PROGRAMS THAT A COMPUTER USES TO CONTROL ASPECTS OF ITS OPERATIONS, SUCH AS TRANSLATING DATA FROM ONE FORM TO ANOTHER. COMPUTER HARDWARE REFERS TO THE PHYSICAL EQUIPMENT.

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WEB RESOURCES

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DESIGNING LEARNING OBJECTS FOR ONLINE LEARNING

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