Learning Objects: A Practical Definition

Learning objects (LOs) enable and facilitate the use of educational content online. Internationally accepted specifications and standards make them interoperable and reusable by different applications and in diverse learning environments. The metadata that describes them facilitates searching and renders them accessible.

Learning Object Repositories (LORs) that are being created house the LOs providing seamless access to a vast store of learning resources such as animations, videos, simulations, educational games, and multimedia texts in the same way that Napster and IPod users have access to music files. LOs are what make this happen.

LOs are sometimes defined as being educational resources that can be employed in technology-supported learning. With appropriate metadata descriptions, they can be modular units that can be assembled together to form lessons and courses. A LO can be based on an electronic text, a simulation, a Web site, a .gif graphic image, a QuickTime movie, a Java applet or any other resource that can be used in learning.

Online, objects used for learning exist and interoperate at different levels of granularity. The simplest level is the content, information or knowledge object. This could be a simple text document, a photograph, a video clip, a three dimensional image, a Java applet or any other object that might be used for online learning. For example, a video clip from an international sporting event such as the World Cup would be an example of a simple media object. It becomes more useful for learners when a lesson is added to it. Many different lessons can be created from one component. This one video clip could form part of lessons in kinesiology, sports science, politics, history, media studies, and many other subjects could be created from this one video clip.

Longer learning experiences or groupings of lessons are considered to be modules. A module normally comprises less than 10 hours of learning. When lessons are longer than 10 hours or if they consist of more than one module, they are considered to be a course. A group of courses that lead toward a certificate or diploma is considered to be a programme. These are all LOs at different levels of granularity as shown in Figure 1.

Many institutions and organizations presently develop lessons, modules, and courses on common topics. Large numbers of similar lessons are being adapted for online delivery. This process can be very time consuming and expensive, making sharing essential. (Downes, 2000) argues that the world does not need tens of thousands of similar learning topics. Just as a cobbler did not go out and kill an animal, skin it, select the desired pieces of hide, and tan them for every single commission, but rather had various pieces in stock from which he could assemble to order, so a dozen well designed multimedia LOs could be used in thousands of courses. Online courses should therefore be designed as a collection of LOs rather than as whole, inseparable, long courses. In order to search for and find these LOs, descriptions of their characteristics are needed. For this you need metadata that describes their many features. Metadata is essential for addressing LOs.
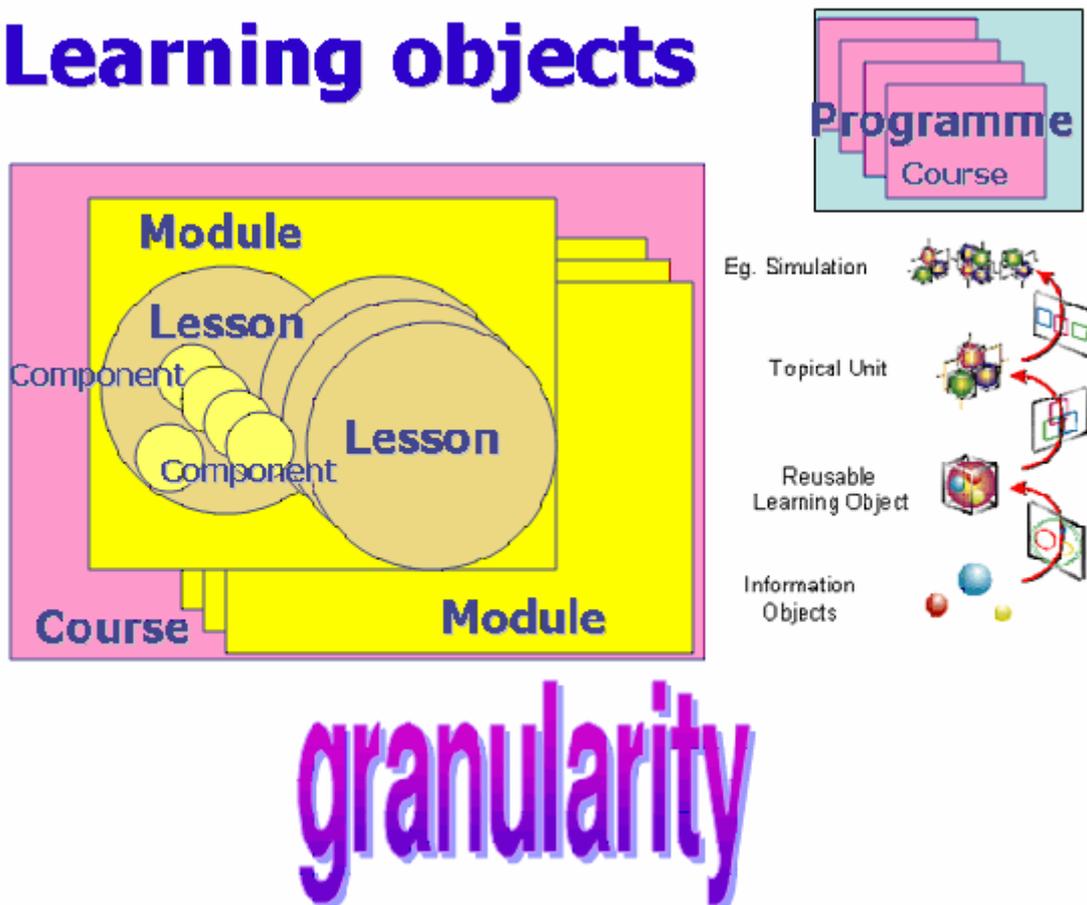
Figure 1: Learning object granularity

In order to search for and find LOs, which might be ideal for a particular course, descriptions of their <u>many</u> characteristics are needed. This is what metadata does. It is essential for addressing LOs. Metadata is often described as being "data about data". This description is not particularly useful without examples, so here is one: Have you tried to find a house when there are no street signs or house numbers? These indicators may not be necessary in small villages, but in large cities, they become essential. Street names and house numbers are widely accepted descriptors that make it easier for people to find a particular building. The street names and numbers are a form of metadata. A library card is another commonly known type of metadata. The author, title, ISBN code are all fields in this standard metadata format

Metadata includes a listing of commonly defined fields for each LO. These fields conform to an accepted set of rules. These rules provide a means of creating, handling and storing data and electronically transferring information using common standards that enable international interoperability. Institutions normally insist on a subset of mandatory fields. These are often accompanied by a larger listing of optional fields. Additional fields can normally be added, so that the specifications are generally extensible.

To date, there is no commonly accepted definitive definition of LOs. It is proving remarkably difficult to come up with a common definition. Nor is there any agreement even on the terms used to describe LOs.

This terminology includes:

- *Asset* (Wiley 2000);
- *Content object*
- *Educational object* (Ilich, 1971; Friesen, 2001; EOE, 2003)
- *Information object*
- *Knowledge object*
- *Learning object* (generic) term credited to W. Hodgins
- *Learning resource* A
- *Media object*
- *Raw Media Element*
- *RIO (Reusable Information Object)*
- *RLO (Reusable Learning Object)*
- *Unit of Learning* (Sloep, in press);
- *Unit of Study*

Table 1
Learning Object Terminology

Anything	Anything Digital	Anything for Learning	Specific Learning Environment
Asset	Content Object	Educational Object	Reusable Learning Object (RLO)
Component	Information Object	Learning Object	Unit of Learning
Learning Resource	Knowledge Object		Unit of Study
	Media Object		
	Raw Media Element		
	Reusable Information Object (RIO)		

An examination of the various terms reveals that despite the differences of opinion, four general types of meaning can be discerned. These are shown in Table 1. They range from the general to the particular. There are 1) objects that could be anything; 2) objects that could be anything digital; and 3) digital objects that have been designed with an ostensible learning purpose or outcome; 4) other objects are specific to a single approach or proprietary standard like those of SCORM or Cisco's RLOs (Barritt *et. al.*, 1999; OASIS, 2003). Figure 2 shows how they fit together. The smaller circles are more specific with meanings fitting within the definitions of the larger more general circles.
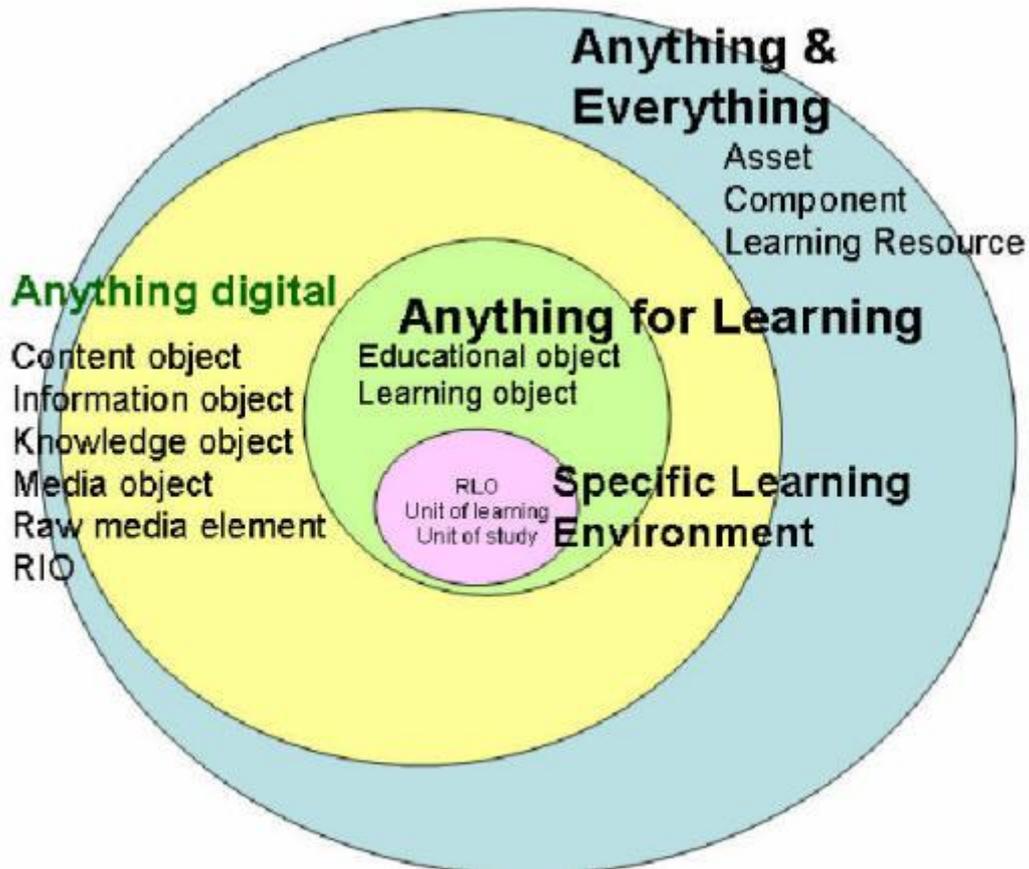
Figure 2: Terminology for learning objects

In line with the terminology, the assortment of what can be considered to be a LO ranges from anything and everything, through anything digital, to only objects that have an ostensible learning purpose, to those that support learning only in a particular or specific context. Among the definitions proposed are the following, moving from the general to the specific:
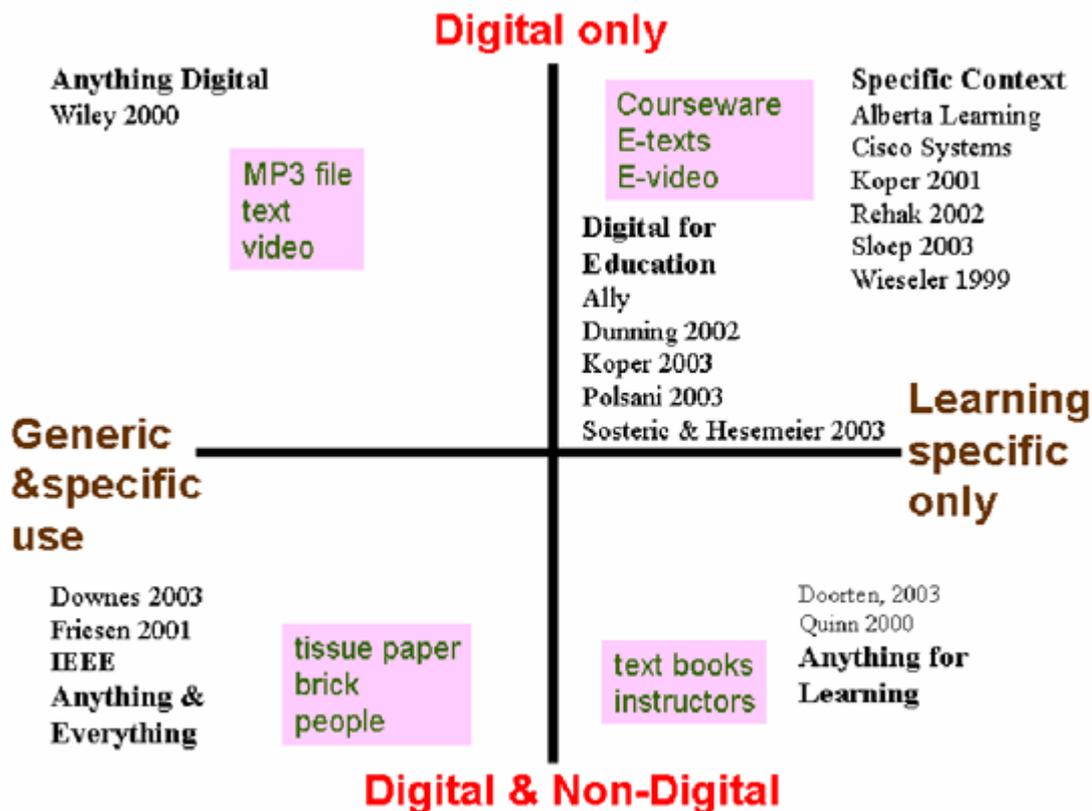
> Anything and everything
>
> Anything digital, whether it has an educational purpose or not
>
> Anything that has an educational purpose (Doorten, Giesbers, Janssen *et. al.* (in press);
>
> Only digital objects that have a formal educational purpose (Dunning, 2002; Koper, 2003; Sosteric and Hesemeier, 2003; and Polsani, in press); and
>
> Only digital objects that are marked in a specific way for educational purposes

A diagram of these views of LOs is available in Figure 3. The north-south line represents the digital only/digital + anything dichotomy and the east-west axis represents the generic to learning specific continuum. The bottom left quadrant shows the extreme position of a LO as being anything, while the opposite quadrant includes both digital LOs with an ostensible learning focus and the more explicit digital LOs for specific implementations. The top left quadrant shows LOs as anything digital opposing the bottom right quadrant showing LOs with a learning focus including non digital objects.

Figure 3: Learning object definitions quadrant

Anything and everything

In most discussions of LOs, participants can agree that LOs are digital, reusable, and are intended to support learning. The IEEE (2002) defines LOs as "any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning." This definition is so broad as to encompass anything and everything. Merrill notes that it is "as small as a drop and as big as the ocean."

Downes (2003), uses the example of tissue paper to argue that anything and everything can be used for learning and therefore must be considered to be a LO. He argues that there is no reason to restrict *a priori* what counts as a LO.

Whether something counts as a LO, depends on whether it can be used to teach or learn, and this can only be determined by its use, not by its nature. People will want to use a wide variety of objects, including even (in at least one case) a used tissue, in order to teach or learn. No good will come, therefore, of limiting a priori what objects will count as LOs and what objects will not (Downes, 2003). The Warwick University group (2004) support Downes' view that use determines whether or not an object becomes a learning object. However, they make a semantic distinction between "asset data", which consists of images, animation, VR models, etc. and "content object", which would also include the metadata that provides a context.

Anything digital

Proponents of this view argue that the terms "learning object" and "educational object" should not be used to encompass non-digital entities such as a book or even an instructor. The word "object" in this term comes directly from object-oriented programming (OOP). This is not a coincidence. The term "learning object" has grown out of the OOP movement (Quinn and Hobbs, 2000). The concept of LOs has been developed from OOP, much to the consternation of some (see Sosteric and Hesemeier, 2002; and Friesen, in press). Therefore, it does make sense to limit the use of the term to digital entities only.

Wiley (2000) settles on a definition of a LO as "any digital resource that can be reused to support learning." Even so, as Wiley comments, "the definition is broad enough to include the estimated 15 terabytes of information available on the publicly accessible Internet." Thus, even restricting the definition of LOs to digital resources still does not narrow down the meaning enough for it to be useful.

Anything that has an educational purpose

Doorten, Giesbers, Janssen *et. al.* (in press) define LOs as any reusable resource, digital or non-digital that can be used to support learning activities. They point out that as long as an object is addressable it can be used. They mention examples such as web pages, applications, textbooks, calculators, and microscopes. Quinn (2000) takes this broader view also and describes LOs as "chunks of educational content" that could be of any media type digital or non-digital.

In contrast to Wiley (2000), who focuses on the digital or "object" aspect of the definition of LOs, discounting the "learning", Doorten *et. al.*, (in press) and Quinn (2000) choose to focus on the "learning" aspect and disregard the "object" (Even though Quinn writes about the link of LOs to OOP). I believe that the reality lies in accepting the limitation that LOs must be digital learning resources. This does not necessarily preclude LOs from referring to external non-digital objects, although this might seriously affect their usability.

Digital objects that have a formal educational purpose

Sosteric and Hesemeier (2002) emphasize the intent of the object more than the structure. According the them, a LO is "a digital file (image, movie, etc.) intended to be used for pedagogical purposes, which includes, either internally or via association, suggestions on the appropriate context within which to utilize the object." They claim that a newspaper article would not be considered to be an LO simply because it could be used for learning. It must be linked to "pedagogical purposes". Polsani (in press), using Peirce's theory of signs, defines a LO as "a form of organized knowledge content . . . involving learning purpose and reusable value."

According to these authors, an information object becomes a LO when it is designed to be used by itself or in combination with other media objects to facilitate or promote learning. This learning should be demonstrable and testable through assessment and observation. To be an LO it must be packaged and made available for distribution as a lesson of some kind.

Duval & Hodgins (in press) refer to LOs as containing information objects, which in turn might contain raw media elements. They refer to aggregate assemblies that

contain LOs and other aggregate assemblies. Dunning (2002) not only accepts that LOs are digital objects that facilitate learning but he seems to limit them to interactive practice exercises used to demonstrate content mastery by applying learnt content. He makes the further stipulation that the LO must also promote critical thinking through linkages to a larger course.

In the same vein, Koper (2003) refers to LOs as "units of learning" defined as digital objects with a specific educational purpose. However, he specifically excludes full courses from his definition. Ally (in press) defines a LO as "any digital resource that can be used and re-used to achieve a specific learning outcome or outcomes". The three key words in these definitions are digital, re-usable, and learning outcome.

Digital objects marked for specific educational purposes

Some LO proponents go further than accepting a generic digital LO approach and add special conditions to their definitions. These conditions either address problems specific to the particular users or just outline a common approach to some of the more precise operations of LOs as online applications. Alberta Learning defines a LO for its own use:

One or more digital assets combined and sequenced to create or support a learning experience addressing a curricular outcome(s) for an identified audience(s). A learning object can be identified, tracked, referenced, used and reused for a variety of learning experiences"

With this meaning, Alberta Learning creates a specific definition of a LO to suit their needs. Cisco Systems (2001) also chooses a specific designation for their Reusable Learning Objects, providing detailed instructions on their formation (see also Wieseler, 1999).

The Digital Library Network for Engineering and Technology (no date) employs a specific LO definition for their use, tied into specific objectives, a designated audience, ownership, and intellectual property rights. The content of their LOs must remain unchanged in any conversion processes.

In explaining SCORM, Rehak (2002) points out that it has been designed to support LOs with a particular use in mind. "SCORM is essentially about a single-learner, self-paced and self-directed. It has a limited pedagogical model unsuited for some environments." The initiators of SCORM: the US government and the Department of Defense have designed SCORM to meet their particular needs for workplace training on job applications and machines. Rehak does not consider SCORM to be suitable for either the K12 or higher education environments.

Koper (2001) and Sloep, (in press), referring to LOs as "units of study" or "units of learning" respectively, believe that an educational modeling language (EML) is necessary to get full power from the learning resources. Their EML now forms the basis of the IMS Learning Design specification and so could become acceptable more widely as being essential for the implementation of LOs in various learning contexts

Conclusion

There are good reasons for restricting which information objects should count as LOs and which will not. When a LO has a formal, expressed learning purpose, the object becomes useful to learners. Learning can be accidental or fortuitous, but it is generally

more efficient when it is focused and directed. Learners cannot always be expected to discern the learning possibilities of any accessed component. That is why we have instructional design. That is why we change information or knowledge objects to LOs. Moreover, the usefulness of a LO can best be evaluated once it has been placed in at least one specific learning context. Once it has been proven to work in one context, it can be better expected to be of some use in others.

In this way, learners can be more easily directed in their learning. This can in turn make it easier for them to achieve an unambiguous learning objective. It can be argued that this brings about an improvement in learning efficiency, which many would consider to be a good thing. In addition, the categorization and standardization of types of learning units allows the same lessons to be learnt by many different players? I suggest that such consistency in learning is of relevance in many situations, for example in skills training, like learning a sport or a foreign language. Distinguishing between information objects that have no ostensible learning objective and LOs is useful. It could be argued that all human knowledge is based on limiting and categorizing the reality that surrounds us.

It can also be seen as a matter of practicality for educators. Professional practice is best served by limiting the definition of LOs to what practitioners typically work with. So it's a matter of usefulness to educators as much as learners.

I propose that a good working definition of LOs should be developed from the two last typologies above: digital objects that have a stated educational purpose; and digital objects that are marked for specific educational purposes. LOs can be defined as **any reusable digital resource that is encapsulated in a lesson or assemblage of lessons grouped in units, modules, courses, and even programmes.** A lesson can be defined as **a piece of instruction, normally including a learning purpose or purposes.** This definition incorporates the top right quadrant of the chart in Figure 3. It is closer to the "Digital for Education" group being broad enough to incorporate the "Specific Context" group.

Summary

As course developers gain experience and as the number of online resources grows, the importance and necessity of LOs and the metadata standards that support them becomes more apparent Efficient learning using the ever-expanding multimedia resources of the Internet will require the creation of LOs and the metadata to describe them. From anything and everything to specific digital learning resources, the future of learning is inextricably linked to the development of quality LOs.

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ACKNOWLEDGEMENTS

Acronyms and Abbreviations

ADL	Advanced Distributed Learning
ARIADNE	Alliance of Remote Instructional Authoring and Distribution Networks for Europe
AU	Athabasca University
CANCORE	Canadian Core Metadata implementation profile
CANARIE	Canadian Network for Advanced Research for Industry and Education
CAREO	Campus Alberta Repository of Educational Objects
EML	Educational Modelling Language
IEEE	Institute of Electrical and Electronics Engineers
IEEE LTSC	IEEE Learning Technologies Standards Committee
IMS	formerly Instructional Management System
IMS LD	IMS Learning Design
K12	Kindergarten to Grade 12 (US primary and secondary schools)
LD	Learning Design (IMS specification)
LMS	Learning Management System
LO	Learning Object
LOM	Learning Object Metadata
LOR	Learning Object Repository
OOP	Object-Oriented Programming
RIO	Reusable Information Object
RLO	Reusable Learning Object
SCORM	Shareable Courseware Object Reference Model