

Running head: Trends and Issues: The Impact of Learning



Figure 1: Educational Learning Object http://belle.netera.ca/info_edobjects.htm, 2003.

Trends and Issues:

The Impact of Learning Objects

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Table of Contents

Trends and Issues:	1
The Impact of Learning Objects	1
Table of Contents	2
Introduction	4
General Background	5
History of Learning Objects (LOs)	5
Definitions and Descriptions of Learning Objects (LOs)	6
Analysis of Learning Objects (LOs)	7
Reasons to Have Learning Objects (LOs)	7
Strategies for Learning Objects (LOs), How Instructional Designers use LOs	7
Categories of Learning Objects (LOs)	9
Advantages/Disadvantages of Learning Objects (LOs)	9
Advantages	9
Disadvantages	10
Best Practices of Learning Objects (LOs)	11
Organizations that Create Standards	12
Implementation of Learning Objects (LOs)	13
Future of Learning Objects (LOs)	14
Systemic Impact	15
Implications of Professional Practice	15
Conclusion	16
Recommendations	18
Appendix A	19

Additional Resource Websites 19

Tables 20

Table 1. Preliminary Taxonomy of Learning Object Types. 20

Author Notes..... 21

References..... 22

Introduction

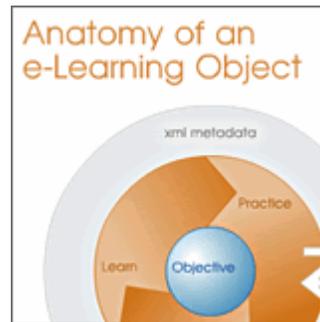


Figure 2: Anatomy of an e-Learning Object

http://www.macromedia.com/devnet/education/articles/learning_objects.html, 2003.

Advances in the field of technology have brought a paradigm shift in the way people learn. The traditional classroom environment is transforming to a blended learning format with the advancement of eLearning or Distance Learning. Schools and businesses are developing online curriculum due to the increase in population, cost, and a bigger geographic scope. Technology is changing how learning is taught. The need to take classroom-based instruction, materials, and information to create a low-cost, high quality instruction in a web-based format has given way to the concept of Learning Objects (LOs). Wiley states that LOs are invading the field of instructional design and technology as the new design and development paradigm of choice (2002). This paper will first discuss the background of LOs, which includes the history and definitions of LOs. Next, we will discuss the impact of LOs on the Instructional Designer and learner. Finally, the paper will discuss the implications of LOs on the present and future of learning. The conclusion will include a personal opinion and recommendations for Instructional Designers who may want to implement LOs in their development plan.

General Background

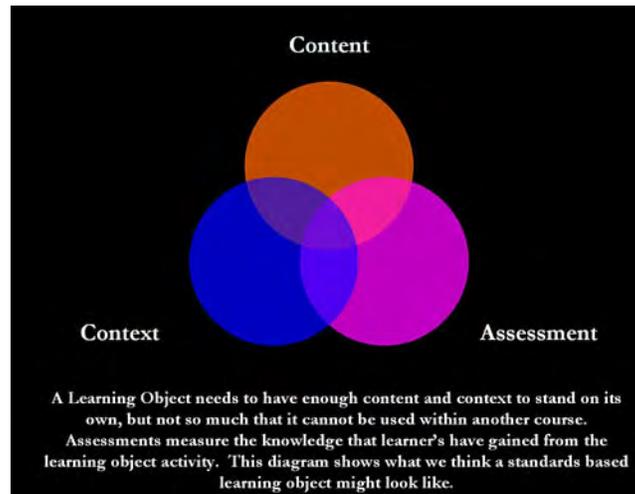


Figure 3: Ideal Learning Object Diagram (Created by Dianne Calhoun and Linda Wooten, November 29, 2003)

The following overview will give the history, definitions and descriptions of what a LO is and what it means for the practitioner.

History of Learning Objects (LOs)

Wiley wrote in his book, “The Instructional Use of Learning Objects” that Merrill and his colleagues did the first serious theoretical work on the idea of using pieces of individual digital resources as the basis for instructional design when they developed the Component Display Theory (CDT) at Brigham Young University in the early 1970s. The CDT evolved into Instructional Transaction Theory, which utilized “knowledge objects” as the components of instruction. In 1994, Wayne Hodgins named a CEDMa workgroup LALO, Learning Architecture, and Learning Objects, which popularized the term “learning objects” (2002).

Wiley also wrote in his book, “The Instructional Use of Learning Objects” that to facilitate the widespread adoption of the Learning Objects approach, the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE) was formed in 1996 to develop and promote instructional technology standards (LTSC, 2000a). At the same time, another venture called the Instructional Management Systems (IMS) Project was just beginning in the United States, with funding from Educom (IMS, 2000a). Each of these and other organizations began developing technical standards to support the broad deployment of Learning Objects (2002).

Definitions and Descriptions of Learning Objects (LOs)

As Instructional Designers, businesses, and schools become more involved in the development of eLearning, various definitions have evolved to explain LOs. One article from the zdev Corporation discusses Learning Objects from a philosophical point of view, “Learning Objects are designed to be used in multiple training contexts, aim to increase the flexibility of training, and make updating courses much easier to manage. Update a part of a learning object and the change should appear in any course using that Learning Object”

(<http://www.zdev.com/definitions/cms/learningObjects>, nd.).

Wiley writes about the following four definitions of learning objects in his book “The Instructional Use of Learning Objects” (2002):

- NETg, Inc, a CBT vendor, describes LOs as NETg learning objects, and defines it in three parts: a learning objective, a unit of instruction that teaches the objective and a unit of assessment that measures the objective (pg. 5).
- Learning Technology Standards Committee (LTSC) states that, "For this standard, a learning object is defined as any entity, digital or non-digital, that may be used for learning, education, and training" (pg. 5).
- NSF-funded Educational Objects Economy (EOE) describes a LO as Java Applets that is an “Object-oriented approach to computer-assisted instruction” (pg. 5).
- David Wiley, a well-respected researcher/practitioner in the area of learning objects, defines Learning Objects as any digital resource that can be reused to support learning. This definition includes anything that can be delivered across the network on demand, large or small, in multiple dimensions (pg. 6).

In the educational field LOs are fast becoming a great way to get small activities of learning across to students as well as stringing LOs together to teach whole courses. Bratina, Hayes, and Blumsack state, “Learning objects are not a recent innovation. However, the way in which educators create and categorize them is changing. The term "learning object" originates from "object-oriented programming" and essentially describes an object that is designed for a specific purpose (to facilitate learning, in this case) and can be categorized by using metadata (i.e., data about data). This categorization enables users to search for, access, and reuse objects as needed. Reusing learning objects makes online learning more cost effective

(<http://ts.mivu.org/default.asp?show=article&id=961>, 2002).

To view a video from the University of Calgary that gives a definition of LOs, visit this website -

<http://commons.ucalgary.ca/showcasetv/displayVideo?movieID=1000068&videoID=1000022>

Analysis of Learning Objects (LOs)

The following sections will investigate various elements or components of Learning Objects (LOs), and then show how the elements relate to each other to help define LOs. With so many different definitions of LOs, it is necessary to look the various elements to be able to analyze LOs as a whole. Wiley says, “Learning objects are elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science. Object-orientation highly values the creation of components (called “objects”) that can be reused in multiple contexts, and this is the idea behind LOs (<http://reusability.org/read/chapters/wiley.doc>, 2000)”.

Reasons to Have Learning Objects (LOs)

Clark and Rossett cite there are many reasons for having LOs, but the following “three R’s” of Learning Objects best describe the reasons

(http://www.clomedia.com/content/templates/clo_feature.asp?articleid=24&zoneid=30, 2002):

- Reduce - Developing materials as a LO reduces the content into manageable bites. By tagging and cataloging them, they become a flexible asset and can be used in a variety of ways.
- Repurpose - Learning Objects can be used for different purposes. For example, sections of a video tape on Presentation Skills could be used in a Communication class as examples for students to review.
- Recycle - Learning Objects are especially successful when recycled for new uses. For example, a videotape about CPR used in a First Aid class for management staff can be carved into a segment of a Health and Nutrition class.

Strategies for Learning Objects (LOs), How Instructional Designers use LOs

With the paradigm shift to LOs, professionals need to change the way they conceptualize and design learning. Most activities tend to focus on eliciting specific responses. Wagner states that developing object-oriented learning designs involves a significant change from behavioral to cognitive perspectives and from objectivist to constructivist perspectives. The goal of complete and correct understanding is to get people to know the entities, attributes, and relations that exist,

unbiased by their prior experience (<http://www.elearningguild.com/pdf/2/061802dst-h.pdf>, 2002).

Constructivism enables designers to design instruction in a myriad of ways. Wagner states, “This suggests that there are many ways in which to structure the world.” As a result, there may not be just one correct meaning or understanding the learner must strive to. Learning is not a response to a stimulus, but is a process of understanding in this setting (<http://www.elearningguild.com/pdf/2/061802dst-h.pdf>, 2002).

In addition, when developing content, Learning Objects can be confusing and misleading without context, which is defined as “a nugget of learning that can exist stand alone” (<http://www.learningcircuits.org/2002/apr2002/mortimer.html>, 2002).

Instructional designers can use the following approaches when trying to create context within the content of a project (<http://www.learningcircuits.org/mar2000/primer.html>, 2000):

- Tailored wrappers – wrappers consisting of information that is associated with a learning object. One LO can have multiple wrappers, “each providing a different way of contextualizing the project.” Using data from the audience analysis, an Instructional Designer can generate various context wrappers.
- Tailored context frames – An object can be personalized with techniques such as humor, visual themes, or information that relates to specific knowledge. Longmire states that the context frames can be designed to match the characteristics of the learner, such as interests, needs, level, knowledge, and performance gaps.
- Adding context links to objects – Links can be added to the learning object that point to outside contact. A good example of this would be if the learner is taking a course on the Internet to learn about cars, and a page that describes what a car looks like, can click on a link to another source that discusses the various models of cars.
- Pattern templates – These templates contextualize information according to the variables defined by the user. One application of pattern templates is the use of competency models to contextualize learning objects in relation to abilities, knowledge, and attributes of excellent performers in an organization (a performance-based approach to using learning objects).

Categories of Learning Objects (LOs)

Trying to identify categories of LOs is not easy when it is so hard to actually define what an LO is, or what its qualities are. Wiley states that there are five types of learning objects that make one type of learning object different from another”

(<http://reusability.org/read/chapters/wiley.doc>, 2000):

- Fundamental – For example, a JPEG of a hand playing a chord on a piano keyboard. (Example - <http://www.pianolessonsonline.com/Lessons/lesson%204a.htm>)
- Combined-closed – For example, a video of a hand playing an arpeggiated chord on a piano keyboard with accompanying audio. (Example - http://www.danmansmusic.com/piano_videos.htm)
- Combined-open – For example, a web page dynamically combining the previously mentioned JPEG and QuickTime file together with textual material “on the fly.” (Example - <http://www.dcpiano.com/>)
- Generative-presentation – For example, a JAVA applet capable of graphically generating a set of staff, clef, and notes, and then positioning them appropriately to present a chord identification problem to a student. (Example - <http://www.teoria.com/exercises/chords.htm>)
- Generative-instructional – For example, an EXECUTE instructional transaction shell (Merrill, 1999), which both instructs and provides practice for any type of procedure, for example, the process of chord root, quality, and inversion identification. (Example - <http://www.funbrain.com/notes/index.html>)

See [Table 1](#) for a preliminary taxonomy of the above learning object types, which Wiley created to help differentiate possible types of learning objects available for use in instructional design.

Advantages/Disadvantages of Learning Objects (LOs)

Advantages

There are many advantages and disadvantages for using LOs that may help you decide whether you want to use LOs or not. Overall, LOs become valuable to companies for saving resources when it comes to building content for pieces of training that is used in several places. Longmire states “the reason designers might want add learning object capability in their design is

that their content gains a “value add” that in most cases will pay off many times over (in terms of costs, development time, and learning effectiveness) and give the following advantages for an argument why (<http://www.learningcircuits.org/mar2000/primer.html>, 2000):

- Flexibility
- Ease of updates, searches, and content management
- Customization
- Interoperability
- Facilitation of competency-based learning
- Increased value of content

Disadvantages

There are some disadvantages to LOs too. First, there seems to be much confusion around how an LO actually is defined. Friesen states, “The term “learning object” suggests neither simplicity, compatibility nor any obvious relative advantage over prevailing teaching practice” (<http://phenom.edus.ualberta.ca/~nfriesen/>, 2003). Second, many organizations are trying to develop standards and specifications for LOs and eLearning. With the varying areas that LOs can be used and how they have been defined creating these standards in a neutral way is a big challenge. Friesen states, “Neutrality, the state of not assisting, or actively taking the side of, helps one understand that for specifications and applications that are truly pedagogically neutral cannot also be pedagogically relevant” (<http://phenom.edus.ualberta.ca/~nfriesen/>, 2003). Last, many of the organizations that are writing the standards seem to have a very rigid approach to what they are dictating for standards. Friesen states, “The SCORM documentation especially resembles a military approach to standards and is very engineering like and hard to relate to educational training” (<http://phenom.edus.ualberta.ca/~nfriesen/>, 2003).

Best Practices of Learning Objects (LOs)

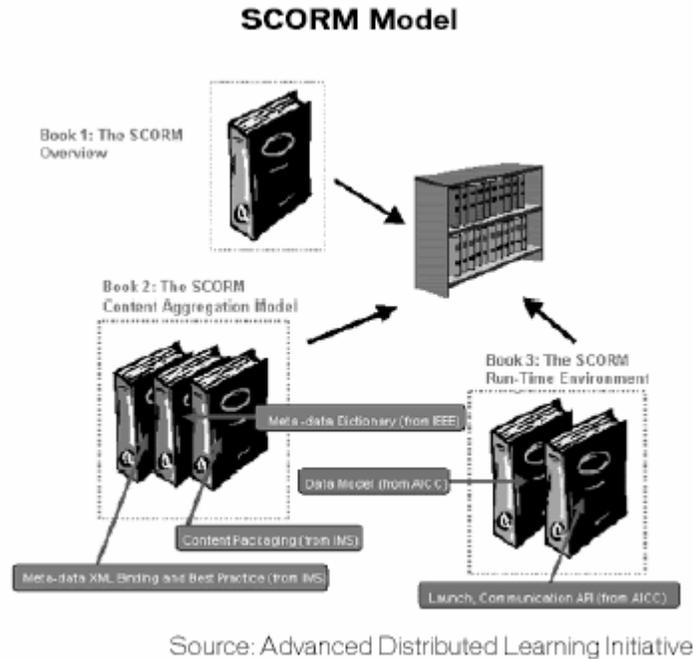


Figure 3: The Learning-Object Economy from http://download.macromedia.com/pub/solutions/downloads/elearning/elusive_vision.pdf, 2003.

The establishment of an accredited open set of standards is needed to realize the full possibility of LOs. Problems can occur when the content is proprietary and not interoperable, such as, LOs cannot be reused or transferred to another system. “Without standards, the value of LOs is substantially reduced. Academic ADL Co-Lab (AADL), the University of Wisconsin System (UWS), and Wisconsin Technical College System (WTCS) state, “LOs will benefit from the establishment of standards like the following” (<http://adlcolab.uwsa.edu/lo/index.htm>, nd):

- Future compatibility
- Longer lifetime of materials
- Smoother migration as platforms evolve
- Easier to locate, access, archive, and reuse with the incorporation of meta data (example found at http://vcampus.uom.ac.mu/lor/display_lo.php?menu=1&loref=147)
- Contribute to critical mass benefiting education in general
- Expand audience
- Compatibility with learning management systems with enhanced functionality

Organizations that Create Standards

IEEE Learning Technology Standards Committee (LTSC) P1484

The IEEE LTSC is one of the world's accredited standards bodies. Over 20 different groups are creating standards using the IEEE LTSC (<http://ltsc.ieee.org>).

Some of the major groups that use IEEE standards are:

- **Shareable Courseware Object Reference Model (SCORM)** - The Department of Defense (DOD) developed these guidelines. It provides a foundation to use learning technologies. “Moreover, the Federal Government can choose multiple vendors, if they comply with the IEEE LTSC standards and the SCORM specifications, for various projects and know that all of the projects and services will interoperate” (<http://learnativity.org/standards.html>, nd.). (Course on SCORM at <http://www.jcasolutions.com/SC12/home.html>)
- **IMS (Instructional Management System) Global Learning Consortium** - IMS is a global consortium that is developing and promoting specifications to facilitate online distributed learning activities. Hodgins and Conner mention several activities: locating and using educational content, tracking learner progress, reporting learner performance, and exchanging student records between administrative systems (<http://learnativity.org/standards.html>, nd.).
- **PROMETEUS: PROMoting Multimedia Access to Education and Training in European Society** - PROMETEUS is a European-based entity that applies and integrates the IEEE LTSC standards with various Special Interest Groups (SIGs). The focus is promoting access to knowledge, education and training for all European citizens. Not only is the issue of standards addressed, but also incorporating multicultural, multilingual learning solutions (<http://learnativity.org/standards.html>, nd).

Implementation of Learning Objects (LOs)



Figure 4: The Learning-Object Economy from

http://download.macromedia.com/pub/solutions/downloads/elearning/elusive_vision.pdf, 2003.

Implementation of LOs varies because of the availability or sharing of LOs between or within companies. Johnson states, unless we create an economy of content in which individuals and organizations can acquire, adapt, and repurpose content; the industry will not be successful. The idea of creating exchanges where everyone could contribute or use LOs would allow for more use of LOs. Every economy is based on markets, and a vibrant learning object economy would likely have at least five, each operating under a different exchange approach. The following are the five approaches he suggests

(http://download.macromedia.com/pub/solutions/downloads/elearning/elusive_vision.pdf, 2003):

1. Proprietary exchanges used exclusively for and individual company or industry.
2. Commercial exchanges used by end users and aggregators who purchase content under specific licenses that allow them to use the objects in clearly defined ways.

3. Free exchanges are primarily used and created in the academic world, but getting funds to support this cause has been hard to find. In addition, quality is not always very good.
4. Shared exchanges have been created to help raise the quality of the LOs by using standards such as SCORM. Often the LOs are only available to the groups who create them.
5. Peer-to-peer exchanges are on the horizon and would use networks like Kazaa or other post-Napster variations. (Software application for peer-to-peer networking at <http://www.etrafficsolutions.com/products/izooloo/>)

Information websites that give various places to find LOs at http://learnware.uwaterloo.ca/projects/CCCO/cloe_about_find.html and <http://elearning.utsa.edu/guides/LO-repositories.htm>).

Future of Learning Objects (LOs)

The future of LOs seems to be reliant on how learning communities choose to use and share them. There needs to be standards so that the LOs have quality, and there needs to be different exchanges where communities have the choice to use or buy LOs that meet their needs for creating training. Shaw gives us several reasons why LOs have a future and what that will look like (http://www.ace.org/dl/files/ELEARN2002/paper_3009_3403.pdf, 2002):

- XML-related technology and standards are maturing
- Primary barriers to implement eLearning are falling, such as, new Learning Content Management System (LCMS) tools will be browser-based and allow users to update learning objects from their desktops
- New Learning Content Management System (LCMS) and Learning Management Systems (LMS) are being priced more competitively.
- Methodologies for design based on the learning object paradigm are still under development.
- Indexing LOs to indicate contexts where they are applicable or reusable.
- Topic maps that provide an approach for combining traditional indexing, library science and knowledge representation, with advanced techniques of linking and addressing (semantic web).

Systemic Impact

Instructional designers and educators can build small chunks of instructional components that can be independently created and maintained, taken apart and reused in different learning contexts. It solves the problems such as maintaining content currency, distributing standards and updates, and replacing the “one size fits all” training with tailored content. Clark and Rossett quote the following people as saying

(http://www.clomedia.com/content/templates/clo_feature.asp?articleid=24&zoneid=30, 2002):

- Cisco’s Chuck Barritt said that learning objects “result in shortened development time when updating existing objects or modifying them for a new audience” and “give the ability to deliver dynamic, prescriptive learning.”
- Joe Jurzyeck of LOBJ.org as saying “the primary benefit coming from different instructors using the same materials in several contexts.”

Implications of Professional Practice

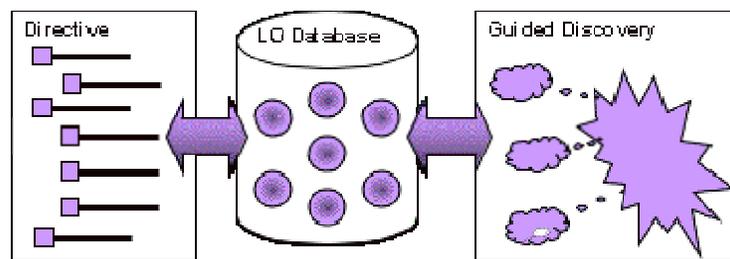


Figure 3: Common Database for all Architectures

Figure 5: The eLearning Developer’s Journal Online Version from <http://www.elearningguild.com/pdf/2/061802dst-h.pdf>, 2003.

In creating LOs, practitioners need to be able to use Instructional Design theory as well as technology. Wiley states, “Instructional design theory, or instructional strategies and criteria for their application, must play a role in the application of learning objects if they are to succeed in facilitating learning” (<http://reusability.org/read/chapters/wiley.doc>, 2000). LOs can be used in many areas that a practitioner creates training. Barritt states, practitioners can use four instructional architectures when creating LOs (<http://www.svispi.org/networker/2002/0702.pdf>, 2002):

- Receptive where instruction is presented in a fixed, linear path from beginning to end. Examples of this type of delivery include, video training, lectures, or any environment where the Performer cannot “skip around” in the “course.”

- Directive where the path for the learning experience is suggested through a hierarchy or ‘learning path’. Examples include books and web based training where there is a "page turning" approach to delivery. It may also be found in simple role-plays or simulations where the number of branches or choices for the Performer is limited and little deviation is allowed.
- Guided Discovery where the performers are encouraged to explore a learning environment. Examples of Guided Discovery applications include rich multimedia simulations, case studies and scenarios where the Performers solve problems or complete tasks as they would on the job.
- Exploratory where the performers are allowed to freely search and “jump” in the content to find knowledge and information that meets their need. Examples include the World Wide Web, corporate information database, libraries, or "on your own" environments. While it is hard to avoid some structure (table of contents for example), the Performer is free to go and do anything they feel necessary to meet their needs.

The use of learning objects in professional practice can have a profound effect on how Instructional Designers create training. Wagner states, “Along the way, learning objects have evolved from a computer programming strategy to a metaphor of interoperable content elements. Ideally these elements can be repeatedly assembled and reassembled, creating an unlimited number of forms” (<http://www.elearningguild.com/pdf/2/061802dst-h.pdf>, 2002).

Conclusion

Even though LOs are hard to define and standards are not being strictly followed, there is still wide use and acceptance for using them. Wagner states, “Learning objects appear to have significant potential for creating highly personalized learning programs, easily updated courses, and performance support tools (<http://www.elearningguild.com/pdf/2/061802dst-h.pdf>, 2002). In order for LOs to be successful, practitioners and technology specialist will need to collaborate with each other to make the process work more easily for all. The technology specialist can help to design the technological aspects, but the practitioners have to follow up with the instructional design theories for a more balanced effect. Wiley states, “The potential of learning objects as an instructional technology is great, but will never be realized without a balanced effort in technology and instructional design areas (<http://reusability.org/read/chapters/wiley.doc>, 2000).

In the future LOs will make it so the learner can choose their own path of learning. Wagner states, “The idea of constructing a personalized learning program is still relatively new. It is also a complex job. The designer must select and assemble learning objects to match learning interests, performance gaps, learning style and presentation preferences” (<http://www.elearningguild.com/pdf/2/061802dst-h.pdf>, 2002). Technology needs to catch up for this new idea of immediate updating the learner’s path to become reality.

Recommendations

1. Become more involved in the process of deciding the best strategy for implementing LOs
2. Become familiar with standards and lead the way to implementing them in the creation of LOs, and join/participate in the standards committees
3. Participate in list-serves and participate in discussions
4. Join professional groups like ASTD, ISPI, and AECT to network with other practitioners
5. Keep your skills, and knowledge current by continuing your own personal training

Appendix A

Additional Resource Websites

1.	Distance Education Clearinghouse	http://www.uwex.edu/disted/lo.html
2.	Constructing Learning Objects	http://www.cat.cc.md.us/~gkaiser/microrlo/LO.html
3.	VCILT Learning Objects Repository	http://vcampus.uom.ac.mu/lor/index.php?menu=1
4.	NLII Learning Object Glossary	http://educ3.utsa.edu/pmcgee/nlii/glossary/
5.	Exploring Adaptive Learning Objects: A Prototype	http://www.flexiblelearning.net.au/innovations/vic65.htm
6.	Learnactivity – Reusable Learning Objects	http://www.learnactivity.com/html/rlo.htm
7.	Oregon Network Education – Courses/Learning Objects	http://oregonone.org/showcase.htm
8.	Wisconsin Online Resource	http://www.wisc-online.com/index.htm
9.	Learning Objects for Introductory Programming	http://www.ics.ltsn.ac.uk/Learning_Objects/lmu_learningobjects/examples.htm
10.	LearningWare, A VCCS Grant Program	http://vccslitonline.cc.va.us/LearningWare/expertise.htm
11.	Preparing Teachers to Use Learning Objects	http://ts.mivu.org/default.asp?show=article&id=961
12.	Storyboard for Learning Objects	http://www.alivetek.com/learningobjects/storyboard.pdf
13.	Learning Object Analysis Sheet	http://www.alivetek.com/learningobjects/analysis.pdf
14.	The Objects of Learning	http://adlcolab.uwsa.edu/lo/index.htm
15.	SCORM Content Development Course	http://www.jcasolutions.com/SC12/home.html
16.	Learning Object Tutorial	http://www.eduworks.com/LOTT/tutorial/
17.	Learning Objects & Standards Resources	http://www.learnativity.org/standresources.html
18.	Designing Courses: Learning Objects, SCOs, IMS Standards, XML, SGML, etc.	http://www.ibritt.com/resources/dc_objects.htm
19.	Objects of Desire – University of Calgary	http://commons.ucalgary.ca/showcasetv/displayVideo?movieID=1000068&videoID=1000022

Tables

Table 1. Preliminary Taxonomy of Learning Object Types.

Learning Object Characteristic	Fundamental Learning Object	Combined-closed Learning Object	Combined-open Learning Object	Generative-presentation Learning Object	Generative-instructional Learning Object
Number of elements combined	One	Few	Many	Few - Many	Few - Many
Type of objects contained	Single	Single, Combined-closed	All	Single, Combined-closed	Single, Combined-closed, Generative-presentation
Reusable component objects	(Not applicable)	No	Yes	Yes / No	Yes / No
Common function	Exhibit, display	Pre-designed instruction or practice	Pre-designed instruction and / or practice	Exhibit, display	Computer-generated instruction and / or practice
Extra-object dependence	No	No	Yes	Yes / No	Yes
Type of logic contained in object	(Not applicable)	None, or answer sheet-based item scoring	None, or domain-specific instructional and assessment strategies	Domain-specific presentation strategies	Domain-independent presentation, instructional, and assessment strategies
Potential for inter-contextual reuse	High	Medium	Low	High	High

This table came from the Instructional Use of Learning Objects: Online Version. <http://reusability.org/read/chapters/wiley.doc> (pg. 24, 2000).

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