

# Looking for a Holy Grail in e-learning: how to create reusable learning objects?

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## 1. EXECUTIVE SUMMARY

If we look around carefully, then despite a number of excellent examples, learning objects (LOs) have not gained significant place in teaching and learning practice in most educational organizations. The number of available repositories and the number of LOs in them is growing, but not as fast as expected. With a myriad of different types of learning materials (from academic content materials to interactive simulation), there is no common understanding about the construction and creation of LOs. Even the definition of the term "learning object" has as many variations as there are different authors. In this situation a tendency arises where any educational material is called a learning object. In this article we shall try to find out the most important compulsory characteristics of learning objects. And as the majority of learning materials are still mainly text-based, we build a simple text based example to illustrate the creation and usage of LOs in different learning situations.

### 1.1. Basic understanding of learning objects

In the present article we refer to LOs as modular digital resources, uniquely identified and tagged, that can be used and reused to support learning.

To allow reuse, a LO has to have number of useful qualities. From number of qualities, described in the literature, we discuss only two groups of them: content ones (reusability, self-containedness and pedagogical neutrality) and surrounding ones (accessibility, compatibility, interoperability). We look at the problem of LO creation and their saving in repositories.

### 1.2. Web 2.0 tools: social bookmarking

We shall take two imaginary courses (Handicraft course in lower secondary school and Beginner laptop users ABC course) which both want to use social bookmarking as a tool in the course. Two simple text based learning objects are constructed that may be used in both courses. In the last part of the paper we analyze, do our Los have the compulsory qualities of the LO, which were stated in the first part of the work.

### 1.3. Conclusions

We hope that by giving a definition, qualities that learning objects must have, and illustrative examples, readers should understand better what we can call LO and what we can not.

Motto: "Reusable content in the form of objects stored in a database has become the Holy Grail in the e-learning and knowledge management communities."

W. Wiesler

## 2. INTRODUCTION

Today you can buy dozens and dozens of books about learning objects (LO). The subject seems to be mature enough to be used widely in learning and teaching practice. But after the initial hype less than ten years ago, things have not gone as smoothly as expected. Why? Predictions were promising: LO repositories will create a market for learning content, this will reduce costs for instructional design, shorten the development time for e-learning courses, different instructors will be able to use the same materials.

But if we look around carefully, then despite a number of excellent examples (Chapman, 2007), LOs have not gained significant place in teaching and learning practice in most educational organizations. The number of available repositories and the number of LOs in them is growing, but not so fast as expected. Reuse and sharing of LOs lack widespread character. For example, in US (Matkin, 2002), with its huge higher education market, corporations and foundations started to finance e-learning content already more than ten years ago, hoping to earn their investment back quickly. But the higher education community is not a very typical community of "consumers", and investors claimed they miscalculated the demand. Cisco, one of the successful implementers of LOs, claims: "Very few organizations have actually developed a methodology to design, develop and implement Reusable Information Objects" (Cisco Systems Inc., 1999). In the rather developed Estonian e-learning community only 3% of teachers participating in the national e-learning conference in late 2007 claimed having used/created LOs.

Many different kinds of LOs exist: interactive videos, slide shows with audio presentations, different kinds of quizzes and surveys, etc. Despite the multimedia takeover, the majority of learning materials today are still text based. They may be presented in a flash format, decorated with some illustrations, pictures, graphic elements, but their core is traditional text. In a learning environment those text materials are usually connected with questions, descriptions of practical activities and quizzes. It seems to many teachers that every text-based material created for educational purposes will serve as a LO. Can all of them really serve as LOs? Do they automatically have good LO characteristics such as reusability, etc.?

Transforming existing content material into reusable LOs is another way to create a rich collection of them. The problem with this approach is that the process of decomposing existing material may require as much attention and time from a subject expert as creating new ones. (Beck, 2007)

In this paper we shall discuss problems related to the creation of some example LOs and shall look how those LOs may be used in the specific context of a real learning process. As a result of this discussion we claim that there are still many problems with practice to use LO.

The e-learning community has not reached a common understanding on many qualities of LOs, such as:

- Granularity, also known as the "Russian doll" problem - what is the effective size of a reusable LO. "... the more useful it becomes, as defined by the possibility of its use in many different contexts, the less interesting it is for any specific use" (Matkin, 2002), "Object granularity will largely solve as best practice emerges. " (Jacobsen, 2001).

- Self contained character of the LO vs. contextualized character of the learning process;

- Not only does one size not fit all, it really doesn't fit anyone. (Matkin, 2002)

We shall start with our understanding of a LO and will explain why it is important to create and use them, declaring what qualities they must have. Then we shall choose two very different learning situations and shall try to present some LOs that can be used in both situations. After that, we shall discuss, whether those LOs really have the declared qualities. We shall not discuss deeper the technical standards, problems of LO finding and retrieval from LO repositories, and tools for their creation in this article.

### 3. BASIC UNDERSTANDING OF LEARNING OBJECTS

There is plenty of literature about Learning Objects (LO), but there seem to be as many different interpretations of the term as there are different authors. Some authors define LOs in a way that there seem to be only LOs in the whole world ("...any entity, digital or non-digital, that may be used for learning, education or training" (IEEE Standard for Learning Object Metadata, 2002)). Others state that learning objects are "smaller units of learning content, typically ranging from 2 minutes to 15 minutes" (Lynch), (Wikipedia). P.R.Polsani, a professor at the University of Arizona, using Charles Sanders Peirce's theory of signs, defines a learning object as a form of organized knowledge content involving learning purpose and reusable value. (Northrup, 2007) M. Doorten and colleagues, in a case study about the Open University of the Netherlands, propose that learning objects are any reproducible and addressable digital or non digital resources used to perform learning activities or to support activities. (Northrup, 2007) Different analogies have been used to explain LOs to novices: LO as a Lego block (Northrup, 2007), atoms which make molecules (Wiley, 2000), etc. In the absence of a universally accepted definition we include a short explanation of how we understand the term before we start to analyze how to create LOs successfully.

In the present article we refer to LOs as modular digital resources, uniquely identified and tagged, that can be used and reused to support learning.

To allow reuse, a LO has to have number of useful qualities. Learning materials which lack those qualities can not be claimed to be LOs.

Compulsory qualities of a LO can be divided into two groups. First group of qualities characterizes the content of the object, second - its additional and technical qualities.

Among the first group of qualities the most important entities are:

- Reusability. Reusability means that an object can be used in different courses, for different target groups, in a different context. Teachers with different pedagogical beliefs may put them into a different place in a learning process. For instance the same LO could be used by university and vocational school teachers in their courses that are totally different by content and difficulty level. Differences in the courses come from different learning process, tasks, exercises and depending also on which other LOs are used.
- Content is self-contained. This means that preliminary knowledge which is needed to understand and manage given LO is minimized. LO has to have as few pointers to other LOs as possible. This forbids all kinds of expressions which are very common in textbooks: "...as we saw in a previous chapter...", etc. All needed preliminary knowledge has to be explained in the same LO, if possible. To prevent a LO to grow unmanageably, the additional explanations have to be in a minimal amount. For example: to explain IP addresses in a networking LO, one needs binary numbers - binary numbers in a interval 0-255 have to be explained in the same LO, not the whole positional number system. It makes it readable for the learners who do not know positional number system; if this is explained in a minimal amount, the text is still readable for those who already know about positional number systems.
- Pedagogically neutral - every teacher can have a possibility to use given LO according to his/her pedagogical beliefs. Different pedagogical processes may be designed using given LO. For example, constructivistic meaning building process can be organized around given LO.

The second group characterizes the surrounding of the LO:

- Accessibility - it has to be tagged with metadata and stored in a special database called repository.
- Compatible with other LOs. This characteristic allows LOs to be combined into larger units (lessons, modules, courses, etc.). LOs created in one operation system with one set of tools must be compatible with objects that are created in another operation system or with other tools. After combining different LOs, in case of need one can synchronize content and design of different LOs (for example different variable names, figures, diagrams, fonts and etc) to put together one unified LO, not a set of materials. Also during the combination additional info, examples and exercises are added.
- Interoperability - it has to be independent of the delivery media, usable in different learning environments. Those interoperability requirements are usually managed by standards. From the many available standards SCORM (Advanced Distribution Learning - SCORM®) version 2004, seems to have become one of the most popular, which growing number of vendors claim to support. It guarantees that a LO, created by SCORM-conformant tool will be easily integrated into SCORM-conformant learning environment.

Many sources cover more different characteristics (e.g. generativity, adaptability, scalability, interoperability and other abilities), but we are discussing only the ones mentioned above because we consider them to be the most important.

### 3.1. Ways to create Learning Objects

Many authors are discussing rapid methodologies to develop learning objects quickly and of high quality. Rapid methodologies are based on effective use of already existing learning objects from repositories. As software engineers reuse a collection of specially designed objects, educators are discussing the problem how to transform existing educational content into object form for effective reuse. The term reuse can be understood in many different ways: 'as is', reuse in different context, reuse with adaptation, etc. (McGreal, 2004, chapter 9).

The free-standing, self-contained nature of the LO makes it difficult to be created by an ordinary teacher. Teachers, either from compulsory schools or from colleges, are used to create by essence sequential materials, where preliminary knowledge is explained in previous chapters. Those materials are used usually for one target group using a single learning process defined by teacher. To create new LOs with all those qualities mentioned in the previous chapter, or transfer existing materials into objects, is difficult and tedious work.

### 3.2. Learning Objects and repositories

Repositories are systems where digital resources can be housed and managed. They exist to search for existing resources, to enable their sharing and reuse.

There are a lot of online repositories of learning objects in the world. They are often very different - use different tagging systems, are specialized to one specific field or are very wide, open to everyone or only for a specified group of people, etc.

Repositories must store descriptive information about each resource. The information, known as metadata, must be associated with each resource in the repository. Metadata may include the resource title, author, resource description, relevant keywords, copyright statements and so on. Sufficient metadata makes the finding of the resources that exactly match their specified needs easier.

All LO repositories can be divided into two groups: the ones that contain only metadata and link to the resources and the ones that in addition to the metadata include also the source itself.

The repositories may be added to other systems, for example to learning management systems (LMSs).

#### 4. WEB 2.0 TOOLS: SOCIAL BOOKMARKING

As more and more different e-learning courses for different target groups start to use Web 2.0 tools to support the learning process during the course, we chose one of those tools for our example. Common name Web 2.0 denotes a wide group of web based tools like value added community services, communication and collaboration tools, etc. Examples of those tools are well known video sharing (YouTube), photo sharing (Flicker), bookmark sharing (del.icio.us (del.icio.us homepage)), podcasting, blogging, collaborative writing tools (Google Docs, Zoho Notebook) and growing number of others.

All these tools have an intuitive user interface, so they are comparatively easy to learn. But to use them successfully for the purpose, some explanations are needed, especially when we want to use them as tools to support learning process of another subject.

The usual way to start to use new tools on a course is that all those hundreds of teachers in compulsory and vocational schools and colleges start to prepare learning materials about those new tools. Therefore it is especially useful to prepare learning objects about topics which are common in many different courses and so the duplication of materials could be avoided.

##### 4.1. Description of two courses

We shall take two imaginary courses and shall try to develop two small learning objects that can be used in both courses.

We shall describe briefly those two courses and then present our LOs. Reader has to hold in mind that the aim of the LOs is not to teach what social bookmarking is, but to pedagogically use social bookmarking as a support tool to teach something else.

###### Case 1. Handicraft course in lower secondary school

In an Estonian lower secondary school a handicraft teacher, who teaches knitting, crochet-work, etc., would like her students to find knitted/crocheted items that they like from the Internet and design, based on these examples, their own work for the semester. She hopes that if students like the item chosen and designed by themselves, they will be more interested in the results and will learn better the technology of knitting/crocheting. All students are asked to register an account in del.icio.us and compile a list of interesting knittings from the Internet. Every found item will be saved in del.icio.us with prearranged tags. As a result students get a good database of ideas and motivation to come and collaborate in the handicraft class.

###### Case 2. Beginner laptop users ABC course

University of Tartu has an electable course for students who are new laptop owners: "Beginner laptop users ABC". The aim of the course is to train new students to be security-conscious users in a university town where there is free wireless connection almost everywhere, and be able to solve computer problems themselves. The teacher of this course wants students to create a list of different common problems with their different vendors' laptops. During the course students have to find information in the web, how to solve those problems and equip every problem with pointers to solutions. The del.icio.us was selected as a tool for this task.

Here we have two totally different situations that both will use social bookmarking tool del.icio.us. We'll create two learning objects: one object introducing social bookmarking and other one about del.icio.us as a tool. Those two objects can be used in both of these cases.

#### 4.2. LO 1: Social bookmarking

Preliminary knowledge: Web, Web address, Internet, browser

Objective: Student will be able to explain the term 'social bookmarking'.

Bookmarking is the practice of saving the address of a Web site you wish to visit in the future. Social bookmarking is a way for Internet users to store, organize, share and search bookmarks on the Web pages, instead of inside the user's own browser. Storing them online allows an access to the bookmarks from any computer all over the world; also it is possible for any user to add bookmarks from anywhere.

The social bookmarking systems are the systems where users can save their bookmarks that they want to remember and/or share.

The bookmarks in the social bookmarking systems can be public or private. The private bookmarks can be seen only by the owner. The public ones can be available either for everybody or only for specific people or groups or inside certain networks.

Tags are one-word descriptions that can be assigned to the bookmarks to classify and describe the bookmarks. To one bookmark as many tags as users wants, may be assigned. The tags may be renamed, added or deleted later as needed. Once the tags have been associated with certain bookmarks, the bookmarks can be organized accordingly and to use this organization to allow user to search needed bookmarks.

Additional piece of explanation that could be added while combining the specific lesson of handicraft course could be:

Students want to make a gift for their teacher. Everyone knits a small square-shaped piece. These pieces are like bookmarks. Then the pieces will be knitted together to make a blanket. This blanket can be compared with a collection of bookmarks with same tags (thinking of teacher).

#### 4.3. LO 2: del.icio.us

Preliminary knowledge: social bookmarking

Objective: Student will able to describe how to use de.icio.us for creating bookmarks in their course.

The website del.icio.us is one of the many social bookmarking Web services for storing, sharing and discovering Web bookmarks. The registration in del.icio.us is optional. If you are registered user you can log in to the system and save your own bookmarks, but if you are not registered or not logged in, you can only see and search what others have tagged and posted.

To post and tag sites yourself you must register. Registration contains three steps - entering personal details, installing buttons and tutorial, how to use these buttons. If you do not install buttons during the registration, you can also install them later from help page.

Buttons are links what you add to your browser's Links Toolbar. They are an easy way to post and view your favorites in del.icio.us. By default there are two buttons installed- "Your Favorites" and "Tag This Page". Clicking at the first button will take you to your saved pages, which are always available at: [http://del.icio.us/\(your user name\)](http://del.icio.us/(your user name)). If you are not logged in, then user name and password is asked. By clicking on the second button you can save the current web page to your del.icio.us account. Before saving the page you can add a description, notes, and tags. If you

highlight some text before clicking on the "Tag this Page" button, highlighted section will go automatically to the notes section. Bookmarks saved with your buttons are by default public.

To add a bookmark to del.icio.us while using a public computer at a library, school, or from a friend's computer (where is no buttons available), you can log in to del.icio.us and click on the post link, type or paste in the URL (web address) of the page you'd like to save, click save, and then describe and tag the page like you normally would.

After saving an item, you can edit its description, notes, and tags by going to your bookmarks and visiting the "edit" link next to that bookmark's description. Similarly, if you'd like to delete an item, visit the "delete" link next to its description.

#### 4.4. Usage of LOs.

Now we shall look, how those two LOs may be used in our two cases (case 1 and case 2) described in the beginning of this chapter.

##### Case 1.

The handicraft teacher prints out the LO about social bookmarking with additional piece of explanation and the LO about del.icio.us. In the class she hands out the printings. With the help of these printings students first get to know what the social bookmarking is. The additional explanation helps them to associate the term with something they are already familiar with. When the teacher has explained them the task they have to accomplish, students start to search for the handicrafts from the Internet and then save the links of the ones found to the del.icio.us by learning how to do this from the LO about del.icio.us.

##### Case 2.

The course "Beginner laptop users ABC" in the University of Tartu has an Wiki page where the teacher puts up the materials for the course. She puts there also the LO about social bookmarking and the LO about del.icio.us. She believes that students must first learn the terms and then use them in practice. As the teacher thinks the terms are important, she creates a small test of terms. For the term "social bookmarking" he uses the LO about social bookmarking. Then the students learn how to use one of the social bookmarking systems del.icio.us from the LO about del.icio.us and do the practical part described in the beginning of this chapter.

### 5. ANALYSIS

In the chapter 3 we created two simple text based LOs. Are they suitable to call LOs? It means - do they have most important qualities of LOs which were described in chapter 2? With Table 1 we try to answer to this question.

Characteristics	LO 1. Social bookmarking	LO 2. del.icio.us
Reusability	Given LOs are used in a lower secondary school and in university first year students course. The same LO may be used in many other different courses where social bookmarking is used as a tool.	
Content is self-contained	Preliminary knowledge for this LO is mainly apparent to Internet users and inevitably most of the nowadays learners (from elementary school up mature students) are Internet users. Content is self-contained.	The pointers to other LOs is minimized - only one LO "Social bookmarking" is needed to understand given LO.

Compatible with other LOs	<p>Present LO can be combined with above mentioned additional explanation and LO about del.icio.us what is specification of social bookmarking. LO can also be compatible with LOs that have totally different content, but together with what they make one undivided learning material.</p> <p>LO is also compatible, because it is self-contained and it could be used in different learning situations and contexts.</p>	<p>LO can be combined with LO about social bookmarking and it could also be combined with other objects that suit the lessons syllabus, but are not about same topic. For example given object could be part of a lesson about how to write a thesis. One part of this could be finding material and saving founded links. So given object could be used even in contexts what are not necessarily about social software.</p> <p>LO is compatible, because it is self-contained and it could be used in different learning situations and contexts.</p>
Pedagogically neutral	LO may be used with very different pedagogical approaches: no pedagogical approach is built in.	
Accessible	Given article does not discuss problems of storing and finding LOs from LO repositories. Therefore a discussion about metadata is irrelevant here. Nevertheless without metadata and LO being situated in proper repository LOs are not reusable what is one of the most important quality of LO.	
Interoperable	<p>In the present case both LOs are created by using plain text, they do not contain any complex internal logic (the capacity to grade a set of tests or case types) or other interactive media (videos, assignments, assessments etc.). That is why these LOs are with high potential for reuse in different contexts or domains.</p> <p>If LOs would contain all this complex internal logic, the creator of LOs must spread risks for loosing reusability and compatibility by using standards to guarantee usability in different learning environments.</p>	

Table 1

#### Conclusions:

Like Wiley has said about LO: „It would seem that there are almost as many definitions of the term as there are people employing it." (Wiley, 2000), we in this article also have defined our way of identifying learning objects. In the article is also given a set of qualities (and their characterization) what one good learning object should have. Additionally two examples of learning objects and an analyzation, to they really deserve LO name, are given. Even further we have presented two different learning situations and context that can be solved with these objects.

Hopefully readers will understand that every digital or non-digital entity what could be used to support learning is not a learning object and based on our qualities evaluation, is the component, unit, element or etc. a learning object, would be much easier.

## 6. REFERENCES

Advanced Distribution Learning - SCORM®. Retrieved January 13, 2008, from <http://www.adlnet.gov/scorm/index.aspx>

Beck, R. J. (2007). Learning Objects. Retrieved December 29, 2007, from <http://www.uwm.edu/Dept/CIE/AOP/learningobjects.html>

Chapman, B. (2007). Reusability 2.0: The Key to Publishing Learning. Retrieved December 28, 2007, from <http://www.chapmanalliance.com/download-documents/Reusability%202.0%20White%20Paper.pdf>

Cisco Systems Inc. (1999). Cisco System Reusable Information Object Strategy. Ver.3.0. Retrieved January, 8, 2008, from [http://www.cisco.com/warp/public/779/ibs/solutions/learning/whitepapers/el\\_cisco\\_rio.pdf](http://www.cisco.com/warp/public/779/ibs/solutions/learning/whitepapers/el_cisco_rio.pdf)

del.icio.us homepage. Retrieved December 27, 2007, from <http://del.icio.us/>

Dianne, B., Wooten, L. (2003). Trends and Issues: The Impact of Learning Objects. Retrieved January 12, 2008, from: <http://www.designbydi.com/UCD/LO/index.cfm?fuseaction=index>

IEEE Standard for Learning Object Metadata (2002). Retrieved December, 27, from <http://ltsc.ieee.org/wg12/par1484-12-1.html>

Jacobsen, P. (2001). Reusable Learning Objects - What does the future hold? Retrieved December, 28, 2007, from <http://teacode.com/biblio/lo/Reusable%20Learning%20Objects.%20P.Jacobsen.doc>

Lynch, P. Teaching & Student Support : Learning objects. Retrieved January, 10, 2008, from <http://www.hull.ac.uk/iq/Teaching%20&%20Student%20Support/Learning%20objects/>

Matkin, G. W. (2002). Learning Object Repositories: Problems and Promise. Retrieved January 14, 2008, from: <http://learn.creativecommons.org/wp-content/uploads/2008/03/learningobject.pdf>

McGreal, R. (2004). Online Education Using Learning Objects. : USA, NY, New York: Routledge  
Northrup P. T. (2007). Objects for Instruction: Design and Evaluation. USA, PA, Hershey: Information Science Publishing.

Polsani, P. R. (2003). Use and Abuse of Reusable Learning Objects. Journal of Digital Information, Volume 3 Issue 4. Accessible from: <http://jodi.tamu.edu/Articles/v03/i04/Polsani/>

Wikipedia: Learning object. Retrieved January, 10, 2008, from [http://en.wikipedia.org/wiki/Learning\\_object](http://en.wikipedia.org/wiki/Learning_object)

Wiley, D, A. (2000).Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. Retrieved January, 9, 2008, from <http://www.reusability.org/read/chapters/wiley.doc>