

# Teaching and Learning Using Learning Object Approach

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## **Abstract**

*One of the challenging aspects of teaching a programming course is how to provide the right information in the right context at the right time to the right person. The goal of this paper is to describe a new approach to a content creation and delivery mechanism for a programming course. This approach is based on the concept of creating a large repository of learning objects, each of which consists of the core material, code examples, supplementary notes, and review questions. The primary aim of this paper is to elucidate how we can proceed from this base to develop a set of learning objects. A central challenge for this work is to elucidate the architecture of learning objects. The paper provides a glimpse of the learning objects, what benefits can be attained using them and how they look like. Secondly, the paper looks at the category of tools for learning objects which are more powerful, flexible and adaptable by local tutors. Thirdly, the paper outlines and tabulates the types of learning objects, and finally the paper proposes model for creating a tool for Learning Objects and concludes that the proposed model would be an acceptable one for both the tutors and the students.*

**Keywords:** Learning objects, Virtual learning, teaching, learning object model

## **1.0 Introduction**

### **1.1 What are Learning objects?**

A Learning Object Repository is storing content/assets/resources as well as their metadata record." From EduTools Glossary Analysis.

### **1.2 What can be done with learning objects?**

Learning objects can be used to[2]

- introduce a new concept or idea
- give students practice with something they are learning
- give students a new experience of a familiar idea
- pose problems for students to solve
- provide a backup resource
- give students practice at something they are having difficulty with
- provide students with a variety of experiences in a learning sequence
- assess student knowledge and / or understanding

### 1.3 What do learning objects look like?

The Learning Object may be a PDF or Word file that contains some information that can be used by different audiences for different purposes. It can be updated, reworded, or used for different literacy levels. The learning experience designed for the learning object determines how it is used.

A PDF learning object would look like:-

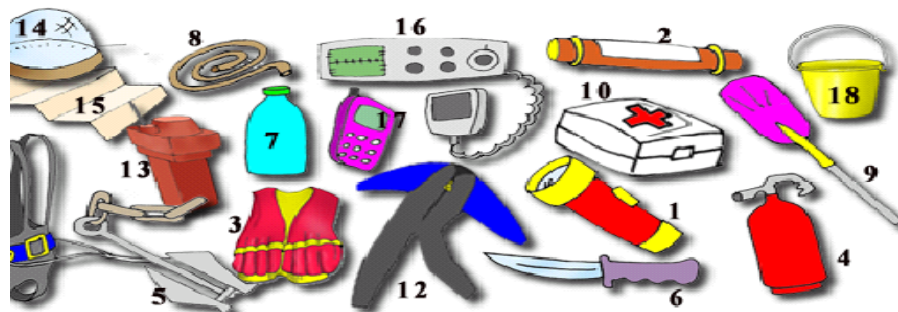
Source Software (FOSS) for Open Educational Resources [3], the tools available to manage the elaboration of LOs can be divided into:

- authoring tools,
- tools to implement learning technology standards,
- learning object repositories,
- learning management systems,
- collaborative environments for sharing LOs.

#### Which safety equipment do you need?

Look at the following pieces of safety equipment. List those that could be useful in an emergency for:

- a small sailing dinghy
- a larger ocean-going yacht
- a windsurfer.



- |                      |                   |  |
|----------------------|-------------------|--|
| 1. torch             | 7. water          | 13. Emergency Position Indicating Radio Beacon (EPIRB) |
| 2. flares            | 8. rope           | 14. compass  |
| 3. life jacket       | 9. paddle         | 15. chart  |
| 4. fire extinguisher | 10. first aid kit | 16. marine radio                                       |
| 5. anchor and chain  | 11. harness       | 17. mobile phone                                       |
| 6. knife             | 12. wetsuit       | 18. bailer   |



### 2.0 Categories of tools for the Learning Object lifecycle

Teachers' communities have shown remarkable interest in the use of learning objects in learning activities in India. This led to numerous tools created to manage the different identifiable phases of LO lifecycle. According to the report on Free and Open

These tools are used respectively in the phases of production, description in conformity to standards, searching, fruition and sharing of LOs.

It is important to note that generally each category of tools covers only one aspect of the LO lifecycle. For example, authoring tools are closely related to the production

phase. There are several types of media that can be produced (e.g. text, audio, video, animations, and so on), and typically each tool handles only a few types and produces digital objects in a proprietary format. It should be noted that most of the tools belonging to this category are not specifically designed to develop LOs; in the past, they could support the production of generic multimedia content while now they have been modified by adding some functionalities to transform multimedia contents to SCORM compliant contents. Tools for supporting the management of learning technology standards are developed with the aim of facilitating the enhancement of the descriptions of LOs, so they comply with the main standards adopted in the field of education. Generally, these tools are used only by expert users that have the appropriate technical background to manage standards correctly[4]. Specifically, these tools are used for the operations of improving LO descriptions by means of metadata (for example using IEEE LOM) or supplying the necessary information for packaging and delivering LOs. Both operations are very important, because the former permits a better description of the resources and a more refined search, while the latter makes the resources usable by the numerous SCORM compliant learning environments, and thus guarantees the interoperability at LMS level.

Learning Object Repositories aim to facilitate the retrieval of LOs, overcoming the limitations of a generic search engine which often provides inaccurate results. Learning Object Repositories can generally be divided into two categories: repositories that store Learning Objects and their metadata descriptions, and repositories that store only the archives of meta-data associated to Learning Objects and the references for retrieving the Learning Objects[9]. Besides, repositories belonging

to the first category are further divided into those that follow a centralized model, in which Learning Objects are stored in a single location, and those that follow a distributed model, in which information is distributed among different connected locations. As far as the search mechanisms are concerned, there are normally two approaches used by Learning Object Repositories for finding stored Learning Objects: in the first, the organization of the content in categories is linked to a taxonomy of the topics; in the second, free searching is allowed by means of the keywords present in the content (when the format allows this) or in the metadata associated to the content.

Learning Management Systems play a key role in the delivery phase of LOs, as they provide student access to e-learning courses. At present, most of them support e-learning standards such as SCORM in order to provide teachers with the tools for the traceability of student activities during on-line learning[5]. Collaborative environments for sharing LOs are a more recent development and provide teachers with specific tools to support resource sharing and collaborative work

### **3.0 Types of learning objects**

According to Wiley [10], there are different types of learning objects. Wiley created a taxonomy for use in instructional design that differentiates these types of learning objects. What separates each type is "the manner in which the object to be classified exhibits certain characteristics". These characteristics are the same across environments, no matter where the learning objects reside.

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
Potential for intra-contextual reuse	Low	Low	Medium	High	High

#### 4.0 The proposed model for creating a tool for Learning Objects

The two main functions of the authoring tool are to enable tutors to:

- Create new objects based on pedagogical patterns;
- Easily and quickly adapt existing learning objects.

In order to achieve the above objectives the three tier structure is proposed comprising **Authoring tool – XML file – Player**

**application.** The authoring tool provides an interface to create or modify learning objects tuned to the outlook and needs of tutors. The output is captured in an XML file. The ‘player’ then reads this file and presents the learning objects to users. A significant advantage of this approach is that the XML file can be read back into the authoring tool, changes can be made, and then exported as a new adapted learning object instance. This conceptual structure does not affect the users of the learning object. To them the learning object seems like one executable entity.

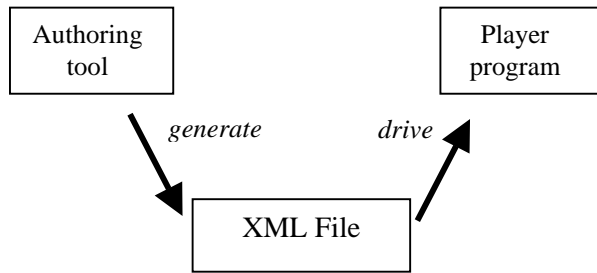


Figure 2: Structure supporting LO authoring

The authoring tool acts at the most basic level like an electronic storyboard that realizes the pedagogical pattern. There are two further important aspects of the tool structure. The first aspect is that this pattern is unfolded hierarchically and mapped onto the ‘storyboard’. The learning object is not mapped directly onto the surface structure of the storyboard. It is generated from consideration of deeper, more basic aspects of the pattern, through to detailed choices on particular screens. In future developments of the prototype each choice point in the unfolding of the structure will have associated options, with commentary to explain the pedagogical function and the solutions offered by these options. The tutor will then be free to decide which option to choose. The tutor can thus choose structural variants of the pattern, as well as tailor content, to create a learning object.

The tool has two modes of operation: adaptation of an existing object or creation of a new object. Modification of an existing object is made as simple as possible. The object is loaded into the ‘storyboard’; each component in the pedagogical design is then directly accessible. Text based changes can be made directly in the storyboard in a WYSIWYG manner. Larger changes, such as replacing an animation can be made by loading (a simple menu choice) the new animation into the storyboard ‘container’ space. This approach supports principled modification, with the modified object being

captured as a new XML file. For example, a new language version of a learning object can be generated by the translator changing only the relevant text based components of the object. In the case of the learning objects for programming, where the same constructs are common across a range of computing languages, adaptation of the ‘same’ learning object for a different computing language (say C++ instead of Java) is made as easy and rapid as possible.

## 5.0 Conclusion

Historically, the production and maintenance of educational contents has required great investment and the employment of multidisciplinary groups of experts. But technological evolutions (i.e. from CD-ROM to Internet technologies) or migrations to different e-learning platforms can make that content obsolete without any possibilities of reuse. In addition, these contents are usually designed as indivisible blocks and this affects reusability between different authors, projects or target audiences.

A methodology to deal with reusability and adaptability problems is the Learning Object Model[11]. This model is based on defining reusable pieces of content called Learning Objects (LO) that can then be assembled to form complete courses. This model permits the reassembly and adaptation of LO to suit the needs of different learner profiles. However, the success of this model depends on the proposal of standard specifications that define the process of creating, cataloguing and documenting the generated content.

The tool proposed is still at the stage of prototype development. The vision is to produce a tool that expresses clearly the idea of executable pedagogical patterns, and makes it easy for tutors to create or modify learning objects based on these patterns. The

tool explicitly expresses its options and operations in pedagogical terms, to enable the tutors to think in terms of executable pedagogical designs.

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