

# KEY ISSUES FOR LEARNING OBJECTS EVALUATION

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Keywords: Learning Objects, Evaluation, Knowledge Management.

Abstract: Web development is promoting important advantages for educational area specially e-learning systems. By one side Learning Objects (LOs) aim the possibility to reuse specific information and by the other side they can be interchanged though different context and platforms according to the user's needs. However an urgent necessity exists to guarantee the LOs quality content. There exists a plethora of quality criteria to value digital sources but there are only a few suggestions about how to evaluate LOs to structure quality courses. This work is a proposal to evaluate LOs as a continued process taking into account different kind of LOs evaluation according to their characteristics and quality criteria related to metadata information, pedagogical and usability issues, together with a strategy to ensure a continued LOs quality contents.

## 1 INTRODUCTION

As consequence of Semantic Web, an important contribution from computer science to knowledge management and e-learning systems is the learning object (LO) concept. This element has characteristics of independent units, which are able to be reused for other educational situations and platforms.

Each one of LOs has metadata (data about data) for their description and administration. In this way it is possible to know what kind of LO we are trying. According to this, knowledge management for e-learning based on reusable units of learning means the possibility to access specific content according to the learners' needs. This stage is possible due to standards, which were established as an attempt to avoid interoperability platform problems, but they don't guarantee the LOs content quality.

A great quantity of criteria exists about digital learning sources evaluation. Nevertheless, for LO content evaluation; there are just a few proposals that are interesting in order to consider their characteristics about how to evaluate LOs to structure quality courses together with the teacher's expert knowledge and the student's learning experience.

On this basis our proposal emphasizes the key issues that need to be considered in order to achieve a suitable LOs evaluation. To achieve this section 2 explains general issues for LOs evaluation considering the LOs context and what kind of LO to manage. It emphasizes the things that are needed to consider for a possible LOs reuse. Section 2.1 presents an input evaluation where it is necessary to value LOs characteristics taking into account pedagogical, usability and metadata issues. Section 2.2 explains our LOs instrument to value LOs according to quality criteria. To ensure LOs quality evaluation and reliability we suggest combining instrument application together with a collaborative strategy which is explained in section 2.3

Finally, section 2.4 suggests LOs evaluation as a Product. It means the possibility of users to make a LOs evaluation after their use. To achieve this, students have to answer questions about their content quality and their-self satisfaction. All information obtained may be given to experts and teachers to advance contents design and to guarantee a continuous quality contents re-feed. Finally section 3 points out our conclusions.

## 2 GENERAL ISSUES FOR LOS EVALUATION

The first thing to take into account for knowledge management is to identify what kind of information to manage. Knowledge is the principal factor which supports innovation and change, and has a strategic value for organizations. For this reason it is fundamental to manage it accurately (Kuang-Tsae et al., 2000).

According to this we define a LO “as a unit with a learning objective, together with digital and independent capabilities, accessible through metadata to be reused in different contexts and platforms” (Morales et al., 2006b).

In order to promote quality LOs management we suggest evaluate LOs according to their characteristics together with the suggestions about who, evaluate, when and what instruments and strategies to use.

In order to promote quality LOs it is necessary to consider the possible context of use. Due to their reusable capability LOs can be interchanged for different educational situations.

According to Stufflebeam (1971) context evaluation focuses on evaluating needs, priorities, shared vision of participants, expectations of people and organizations, and how their efforts fit into broader time and location contexts. According to this we think LOs context evaluation need to consider the following issues:

**Curricula:** LOs must be suitable for the new educational context curricula plans.

**Student characteristics:** LOs need to be suitable for students’ previous knowledge.

**Learning objectives:** LOs need to have all the necessary elements in order to achieve learning objectives.

**Technical requirement:** The new context in which LOs can be reused need to have suitable LOs technical requirement, e.g. suitable computers and Internet connection, etc.

According to reusable LOs capabilities, we consider to evaluate external LOs (imported, buy, etc.) or create them. The possibility to import or create LOs enables to enrich a Knowledge Management System. However the first thing to consider is what kind of LOs we are trying. On this basis we think it is necessary to normalize them because in this way it is possible to guarantee a suitable degree of granularity. To achieve this, we suggest the next steps (Morales et al., 2006b).

- Classify LOs components: LOs may be classified for different purpose by the metadata “9.Classification”. According to this users can define some characteristic for them adding a vocabulary to the metadata schema. To achieve a better LOs management we suggest the following LOs classification.
- Classify LOs objectives according to their cognitive domain: In this way it is easier knowing about their compatibility for suitable new educational situations. Then, we suggest Bloom’s cognitive domain taxonomy (Bloom, 1956) because it defines what and how to learn according to complexity levels: low level (knowledge, comprehension and application) and high level (analysis, synthesis and evaluation).
- Classify LOs into three kind of content: data and concept, procedure or processes, and reflection or attitude. This classification aims to define the kind of content according to the learning objectives. This is an important issue for teachers because it aims them to search a specific type of LOs and easily structure their courses.

Evaluation which compare alternative inputs or means for meeting the needs identified in context evaluations, including but not limited to LOs (Stufflebeam, 1971). It focuses on evaluating alternative inputs that could be considered for addressing concerns such as vision, purposes, alternative curricula, instructional strategies, participants, technologies, etc. According to this we propose an input evaluation after LOs normalization. In this way it is possible to evaluate them taking into account a uniform structure.

### 2.1 LOs Characteristics Evaluation

There are a lot of KMS possibilities to support the teaching and learning process through e-learning systems, such as delivering and evaluating courses, etc. (Rosenberg, 2001; Avgeriou, 2003). However, according to LOs and standards capabilities, it is necessary to consider how to manage quality LOs, taking into account their characteristics.

In order to promote a whole LOs evaluation we suggest evaluating them taking into account different points of view: Pedagogical, Metadata and usability.

**a) Pedagogical:** LOs are units of learning, for this reason we think it is necessary to consider pedagogical issues, according to this we propose to evaluate psychopedagogical and didactic-curricular characteristics.

- Psychopedagogical: Contains pedagogical criteria related to the psychology of learning. This kind of criteria aims to determine if the LO is suitable to promote learning.
- Didactic-curricular: This kind of criteria aims to evaluate if a LO is related to curricular objectives according to the context in which it will be applied.

**b) Usability:** This concept is related with the ability to achieve goals efficiently into a specific context. Web design area has adopted this concept in order to obtain a suitable and efficient interface design. According to Nielsen (2001) we suggest to define quality criteria for content design and site map design.

- Content Design: It is directed to technical issues about images, text, video, animations, etc.
- Site Map Design: It encompasses main page and site map navigation

**c) Metadata:** Taking into account this situation and the low flexibility of LOM the only one metadata specification approved some metadata schema initiatives exist in order to attend specific context and users that is called application profile.

LOs are characterized by the separation of their content and presentation, for this reason an important issue to consider evaluating them is their metadata information. Metadata, provide LOs information to their description and managing, in this way it is possible to know if their characteristics are suitable for other educational situations. Our proposal is based on IMS specifications, for this reason we refer to metadata according to IMS LOM (IMS, 2005). However, in a way to made a context evaluation we suggest the following application profile.

- **1.General:** The elements mentioned into general category are very important in order to manage LOs. It is because they contain information which it is necessary for their searching.
- **5.Educational:** Educational information aims to know pedagogical LOs characteristics which it is necessary to take into account before to reuse them in other educational situations.

- **7.Relation:** Relation metadata information aims to know the type of LOs we are trying and their relations with other ones. This information is very useful in order to establish LOs sequence.
- **8.Annotation:** Description element into annotation category aims to describe experiences about LOs application. This information is very useful in order to know if the LO is suitable for a specific learning situation.
- **9.Classification:** This category aims to describe LOs into a specific classification system. IEEE LOM (2002) defines some values for it (idea, learning objective, accessibility, etc). However we think it is necessary to consider LOs classification according to users need. In this way we suggest to use this category to classify LOs according to kind of contents, cognitive level and quality value.

Metadata Categories	Metadata Elements
1.General	1.2 Title 1.4 Description, 1.5 Keywords, 1.6 Coverage,
5.Educational	5.1 Interactivity Type, 5.2 Learning Resource Type, 5.3 Interactivity Level, 5.4 Semantic Density, 5.6 Context, 5.7 Typical Age Range, 5.8 Difficulty, 5.9 Typical Learning Time, 5.10 Description, 5.11 Language
7.Relation	7.1 Type, 7.2 Resource,
8.Annotation	8.3 Description,
9.Classification	9.1 Purpose, 9.2 Taxon Path 9.2.1 Source 9.2.2 Taxon 9.2.2.1 Id 9.2.2.2 Entry 9.3 Description 9.4 Keyword

Figure 1: Metadata categories and elements suggested for LOs management.

The classifications of LOs provided for the knowledge model allow teachers to find content according to the cognitive domain and type of content. By other side it provides to learners different kind of content to achieve their educational objectives. Nevertheless, LOs normalization is not enough to guarantee their quality. To ensure a quality LOs from a pedagogical point of view we suggest to value LOs quality through and evaluation instrument.

### 2.2 Evaluation Instrument

In order to evaluate LOs we designed an instrument as shows figure 2. As we mentioned above the instrument take into account quality criteria for pedagogical issues (Psychopedagogical and Didactic-Curricular) and usability issues (Content Design and Site Map Design). The figure 2 shows an example of psychopedagogical quality criteria.

For evaluating LOs there is a range scale, if evaluators don't know how to evaluate it or if they have a doubt it is possible to select DN= Don't Know, otherwise they can to select the following rate scale 1=very disagree, 2=disagree, 3=agree, 4=very agree.

For example, there are quality criteria related with LOs objectives, contents, and activities, each one of them has a final score that aim to know their individual scoring and reinforce them if it be necessary. According to this, the final scoring of each category is average out at the field "final score". In case of any doubt, critic or suggestions evaluators have a comments section. To evaluate LO reusability the instrument contain a section called

"Reusability" where it is possible to comment possible context of use.

### 2.3 Evaluation Strategy

Patton (1997) argues that the key to evaluation utility is to identify people who are disposed to learning from evaluation. He outlines several procedures for identifying these users an then working with them to clarify what they want to know and what they are likely to do with information gathered by an evaluation.

Input evaluation is directed to experts related with educational area who have to evaluate LOs in an individual and collaborative mode.

Individual evaluation provides us an initial appreciation of the quality of the LO based on the judgment of each participant. According to (Vargo et al, 2003) collaborative evaluation aim to encourages not only different points of view over the subject under evaluation, but also a critical objectivity and a reliable LOs evaluation.

The possibility of completing an evaluation through collaborative method enables to contrast the individual's initial evaluation with the others experts' evaluations. It aims to share different points of view to achieve an advanced and reliable evaluation (Vargo et al, 2003).

In order to help teachers in this work by one side our tool aim to analyze graphics which show statistics that reflect individual an collaborative evaluation and by the other side it provide a forum for discussions to achieve an agreement for a final evaluation.

PEDAGOGICAL ISSUES		CRITERIA	D/N= Don't know, 1=Very Disagree, 2=Disagree, 3=Agree, 4=Very Agree
PSICOPEDAGOGICAL	<b>Motivation and Attention</b>		
	<u>Presentation:</u> captute learners attention mantaning their motivation		
	<u>Add important information:</u> Information need to be relevant according to the LO subject		
	<u>Learners participation:</u> Learners need to find out what to do		
	<b>Professional competence</b>		
	learning objectives need to help users to achieve their professional competences		
	<b>Difficulty level</b>		
	contents difficulty level: It need to be suitable for user cognitive domain		
	<u>Language:</u> It needs to be suitable for previous users knowledge		
	<b>Interactivity</b>		
	<u>Interactivity Level:</u> It promotes opportunities to interact with LO in different ways		
	<u>Interactivity type:</u> LO interaction aim to achieve learning objectives		
	<b>Creativity</b>		
<u>It promotes self-learning</u>			
<u>It promotes cognitive domain development</u>			
<b>COMMENTS</b>			

Figure 2: Pedagogical issues for LOs evaluation through evaluation instrument.

## 2.4 Product Evaluation

According to Williams (2000), students or learners are some of the most important users of LOs. And of course, they vary in their needs and values even more than instructors do because there are more of them. But eventually students have to evaluate any given learning opportunity and choose to learn from it or not. According to this learners are the key for LOs evaluation.

Once students have finished their lesson they have to respond questions about their satisfaction with the LO. Each one of these questions is related with LOs evaluation instrument; in this way it is possible to contrast them with previous experts' evaluation.

Product evaluation aims to re-feed LOs quality, because it considers a learners' experience about the efficacy of the LO to improve their knowledge (Morales et al., 2006a); (Morales et al, 2006c).

Taking users responses, evaluators may have to re-feed LOs to guarantee their continued quality.

After LOs evaluation they must to be saved into a repository which contains normalized and quality contents. From this repository teachers could search LOs to structure their courses offering quality contents for their students. These contents will be part of biggest units of learning like lesson, modules, courses, etc. and they will be published by e-learning system for their usability and be continually evaluated to guarantee their quality.

Stufflebeam model (1971) define process evaluations stage as an evaluation that formatively assess the planning, design, development, and implementation of learning objects and associated efforts to use them, including attempts to adapt instruction based on individual differences as

expressed in learner profiles, etc. Taking into account Process evaluation focuses on evaluating the processes being used to address needs clarified in the context evaluation and the use of various inputs to carry out a program or project. Examples of processes include organizational structure, instructional strategies, cooperation among organizations, use of technologies, involvement of faculty, curriculum development, course development, organizational change, etc.

According to our proposal, we consider process evaluation for course development. Therefore a re-feeding process is needed which taking into account students' and teachers' contributions to the LOs quality. To achieve this, the process evaluation consist on users comments during their interaction with LOs. Users can contribute with valuable and unexpected comments to consider improving LOs quality and teaching and learning process. Then we suggest creating a forum for users' comments about the process.

## 3 CONCLUSIONS

LOs evaluation is a complex area in development. It is because there is not a consensus about things like LOs definition, size, reusability, etc. Most of LOs proposals are directed to achieve a suitable LOs management from a technical point of view in order to guarantee their characteristics reusability, accessibility and interoperability for automatized process.

Nowadays it is possible to find a lot of tools for help this task like metadata editors, e-learning platforms, etc. However in educational area LOs needs a special attention. According to LOs

QUESTIONS					EVALUATION
<b>Psychopedagogical Issues</b>					
I felt motivated during the lesson					
The level of difficulty was suitable for my previous knowledge					
My participation was clearly explained					
<b>Didactic-curricular Issues</b>					
Subject description was clear (Summary, Introduction, etc.)					
I have achieved the learning objectives					
Contents were solid (suitable for objectives, enough information, reliable, supported by references, etc.)					
Activities and self-assessment were clear and meaningful for learning					
Time was enough to achieve the learning objectives					
There were contents feedback					
<b>Technical-Aesthetic Issues</b>					
Interactivity Level: Suitable to achieve the learning objective					
Suitable and orientative navigation (easy access, suitable and orientative links, etc.)					
Content design was clear and orientative (colours, letter size, suitable figures, important information emphasized, etc.)					
<b>FINAL EVALUATION</b>					
<b>COMMENTS</b>					

Figure 3: Pedagogical issues for LOs evaluation through evaluation instrument.

definitions they must be directed to teach a little unit of content. However to achieve this objective LOs must have a suitable instructional design that aim to achieve their educational objective.

We think our LOs definition may be suitable for LOs management because it promotes simple LOs contents that could help to reuse them in easily.

Our normalization proposal helps to promote a uniform LOs level of granularity and the possibility to increment LOs reusability to another specific context. It is because relating a LO to knowledge domain aim to attend different educational situations for different requirements.

Each one of pedagogical evaluation criteria aim to evaluate LOs characteristics into a concrete set, providing specific criteria for LOs evaluation for experts into an individual and a collaborative strategy. This issue has a special value because criteria are situated into psychopedagogical and didactic-curricular areas. However an expert evaluation must be reinforced with users' evaluations, which might contribute their experience and express their satisfaction.

IEEE LOM metadata elements have a complex structure, thus it is not very clear what kind of information to add. Our proposal considers specific metadata elements for a suitable LOs management and issues to consider in order to adding information in a suitable way. By other side "classification" metadata element is part of an official metadata proposal, and it can be used for personalized applications profiles in order to classify the LOs according to their particular educational needs.

We want to emphasize that our proposal is an attempt to solve questions about LOs evaluation. However it doesn't guarantee the quality LOs management for e-learning systems because it depends of many issues like platform capabilities, usability, accessibility, etc. which are out of this specific proposal. However this work proposes some ideas to improve LOs quality from an instructional design point of view that must be applied both, instructional design and metadata information.

## ACKNOWLEDGEMENTS

This work was partly financed by Ministry of Education and Science as well as FEDER Keeps project (TSI2005-00960).

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