QUALITY CONTENT MANAGEMENT FOR E-LEARNING
General issues for a decision support system

Erla Morales
Departament of Theory and History of Education, Salamanca University, Canalejas Street 169, Salamanca, Spain

Francisco García
Department of Computer Science, Salamanca University, Merced Square, s/n, Salamanca,Spain

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Abstract: In today's world, reusable learning object concepts and standards for their treatment represent an advantage for knowledge management systems to whatever kind of business that supports an on-line system. Users are able to manage and reuse content according to their needs without interoperability problems. The possibility of importing learning objects for e-learning aim to increase their information repository but the learning object quality is not guaranteed. This work proposes a system to manage quality learning objects to support teachers to select the best content to structure their course. To achieve this we suggest two subsystems: First, an importation, normalization and evaluation subsystem; and second, a selection, delivery and post evaluation subsystem.

1 INTRODUCTION

Through an e-learning repository we can find a myriad of content from academic research and contributions, but how about the content's quality?

Without doubt, 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. According to this, knowledge management for e-learning based on reusable LOs means the possibility to access specific content according to the learners' needs.

The stage mentioned above is possible due to standards, which were established as an attempt to avoid interoperability platform problems. Thanks to reusable LOs and standards for their treatment, knowledge management becomes more easy and efficient but it doesn't guarantee the content quality.

A great quantity of criteria exists about digital learning sources evaluation. Nevertheless, for LO content evaluation there are just a few proposals which consider their characteristics. So it is necessary for a knowledge management system to frequently re-feed the content for an e-learning repository together with the teacher's expert knowledge and the student's learning experience. In this case we are focused on teacher's expert knowledge.

On this basis, section 2, presents general issues for LOs management. Section 3 presents the main elements for systems to support decisions. Subsection 3.1, presents a subsystem to import LOs from external sources, followed by our recommendation to normalize them according to a knowledge model and finally to evaluate them through an instrument and collaborative strategy. Subsection 3.2 explains another subsystem that supports decisions and content re-feed. Finally, section 4 summarizes conclusions and further work.

2 LEARNING OBJECTS MANAGEMENT

The knowledge management we suggest is based on reusable LOs. The most widespread definition is from (IEEE LOM, 2002) that states the "digital or non-digital entity that may be used, reused or referenced while the learning receives technical support"

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However, this concept is too broad to guarantee an efficient resources management. We believe LOs should represent at least a single instructional objective and all of the related materials required to support that objective

For this reason we propose a definition adapted by (Polsani, 2003) "A Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts", on this basis we refer to learning objects which contain a unit of learning with educational sense, for example a lesson.

3 A SYSTEM TO SUPPORT DECISION

According to LOs and standards capabilities, it is necessary to consider how to manage quality LOs, taking into account their characteristics to help teachers to structure their courses. For this reason we suggest a system to support decisions about how to select the best content from a LOs repository. Figure 1 presents a general view about the system we propose which will be explained in the next sections.

3.1 Importation, normalization and evaluation subsystem

A first step we must consider is to import LOs content to the e-learning repository. According to this, for knowledge management it is necessary to take into account some questions about content such as what, how and why should it be managed (Kuang-Tsae, 2000). Taking these issues into consideration, imported LOs may be selected with regard to context issues (Marquès, 2001). On this basis, some keywords may be used for searching a suitable LO.

After that, the imported LOs can be saved into a non–normalized content repository, because each one of them could has a different granularity level than others ones. Therefore, to import LOs from external sources the second step we suggest is to normalize imported LO's according to a knowledge model. To achieve this, we suggest the next steps to normalize LO's.

1.- *Clasiffy LO's objectives according to their complexity level*, because this way it is easier knowing if the LO is suitable for new educational situations. Then we suggest Bloom's cognitive domain taxonomy (Bloom, 1956) because it has been widely used in e-learning to define cognitive objectives and also it divides the objectives into high and low complexity levels.

2.- *Define the difficulty level to each one of LO*, for this ussue we propose three kinds of complexity levels: basic, medium and advanced because this kind of clasiffication would help teachers to select the LO content according to their teaching objectives.

3.- *Classify the imported LO into three kind of content areas*: data and concept, procedure or processes, and reflection or attitude. This classification aims to define the kind of content according to the learning objectives.

4.- *Classify the imported LO into three kind of activities*: Initiation, Re-structuring and Application. Initiation activities classification may be for all LOs, which are designed to teach basic content for a specific subject. Restructuring activities classification may be directed to promote new knowledge acquisition. Finally, applying classification activities may be directed to promote students' experience in order to achieve their new

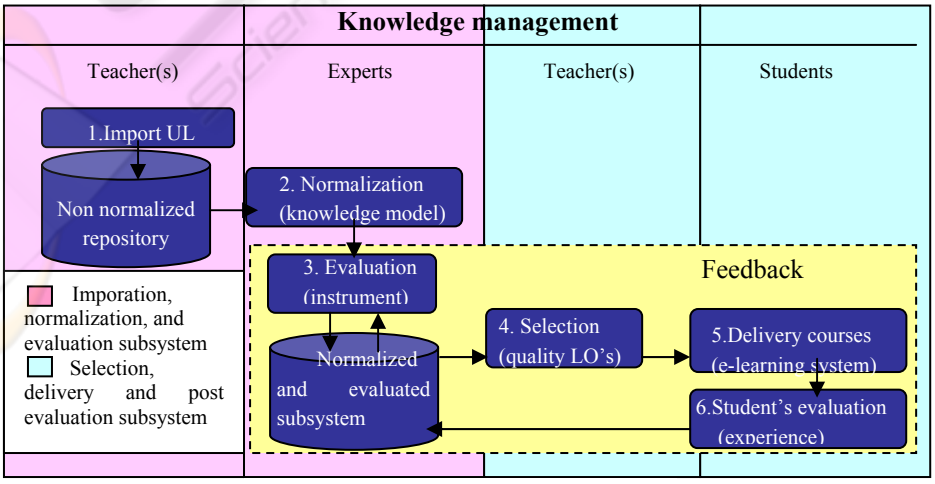

Figure 1: A decision support system

concepts acquisition.

Nevertheless, the classification of the LO according to a knowledge model like this is not enough to guarantee the LO quality.

There exists is a plethora of quality criteria to value digital sources but there are only a few proposals about how to evaluate LOs

In order to achieve an optimal evaluation of the LOs, it is necessary on one hand considering quality criteria from different kinds of categories to each one of LO, and on the other hand, considering the LOs evaluation models (Merlot, 2003; Vargo et al., 2003, Williams, 2000). In this way, it is possible to consider different points of view with regard to the same object. According to this we suggest a third step for knowledge management to support decisions, it is an instrument which considers different evaluation criteria in four categories.

Psychopedagogical category (30%): This kind of criteria aims to determine if the LO is suitable to promote learning, for example, learner's motivation.

Didactic-curricular category (30%): This kind of criteria aims to evaluate if an object is related to curricular objectives according to the context in which it will be applied.

Technical- aesthetic category (20%): Technical-aesthetic criteria aim to evaluate issues like legibility, color-contrast, etc.

Functional category (20%): It aim to evaluate if an object work correctly and doesn't obstruct the learning process.

From the stages mentioned above, the psychopedagogical and didactic-curricular categories are more important than technical-aesthetics and functional categories within the educational context, then, we do not propose evaluating them with the same score weighting. We suggest evaluating each object with the same rating scale but applying a different percent.

For getting the final result, we propose calculating the average score gained for each object according to the percent weighted for each category with the following rating scale: 0 = Criteria is not present; 1 = Very low; 2 = Low; 3 = Medium, 4 = High, 5 = Very high.

Due to the fact that an optimal LO evaluation considers criteria from different kinds of categories, we suggest the participation of different kinds of experts during the evaluation, for example: instructional designers, subject experts, and so on. The participation of at least one participant from each area encourages not only different points of view over the subject under evaluation, but also a critical objectivity and a reliable LO evaluation.

We propose two modes of applying the instrument suggested above in order to value the LO: individual and collaborative method.

According to this concept, individual evaluation provides us with an initial appreciation of the quality of the LO based on the judgment of each participant.

For making easier this evaluation firstly we propose the possibility to view the LO Metadata (IMS LOM, 2003) through the e-learning platform. It allows to the evaluators knowing quickly LOs characteristics. After, we propose that the evaluators may view all the evaluation indicators classified into each category. It allows that the evaluators may know the meaning of the criteria that they are testing.

For the evaluation of LOs characteristics we suggest two criteria. The first one is LO reusability, which means assessing whether the LO can be reused for other educational situations (into didactic-curricular category). The second one is ensuring standard compliance (into technical-aesthetic category).

The possibility of completing an evaluation through collaborative method enables one 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). However, the emergence of consensus is not always a fact, so we suggest publishing evaluators' disagreements through the platform, and as a result it will be possible to consider this information before the LO is reused.

3.2 Selection, delivery and post-evaluation subsystem

Once LOs evaluations are completed they will be saved on a normalized repository, as shown between three and four steps in Figure 1. This repository will be required for teachers to search the content they need to structure their courses, and from this repository teachers can find quality and uniform LOs.

Numerical ratings provided through the evaluations mentioned above allow quick comparisons for searching LOs.

LOs classifications provided for the knowledge model and their evaluation allow teachers to find content according to the subject area, type of content, type of activity, and level of difficulty (retrieving content associated with Bloom's cognitive domain categories) and their numerical evaluation, which reflect their quality.

To achieve an optimal LO selection for reuse, we suggest a knowledge management system with the possibility to view a list of all the final LOs evaluations and the possibility to access evaluation criteria by links. As a result, it becomes easier to

recognize which elements of the LO are weak and find a way to correct, improve or change them.

LOs needs to be enabled with other ones to build the largest units (didactic units, courses, etc.) possible to deliver selected LOs for students, such as those shown in step number five in Figure 1.

To achieve this objective, an educational modeling language is needed. We also suggest IMS Learning Design (IMS LD, 2003) because it has a flexible structure that supports pedagogical diversity. The classification provided by the knowledge model could help for this work.

However, the LOs evaluation we suggested is not definitive. Once the LO evaluation has ended, it is necessary to make a LO re-evaluation, which considers a learners' experience about the efficacy of the LO to improve its quality as shows six steps in Figure 1. Therefore a re-feeding process begins taking into account students' and teachers' contributions to the LOs quality. As Figure 1 shows, the re-feeding process is a cycle in which content is constantly evaluated for all the e-learning users.

4 CONCLUSIONS

We think the general issues discussed here have important advantages. Nowadays, the LO concept is widely discussed, however we are suggesting and specific definition to their evaluation and management for e-learning systems. In this way it is possible to define what criteria and what quality indicators we could use to evaluate them.

On other side, due to the different kind of LOs definitions, a lot of LOs with different levels of granularity exists. A knowledge model, like ours, aims to normalize the imported LOs. In this way, it is possible to manage uniform LOs for their evaluation and classified them according to an educational context.

The type of evaluation we are suggesting has several advantages in comparison with other proposals. There are few ways about how to evaluate learning object, for example, MERLOT (2003) proposes an evaluation with stars from 1 to 5, considering just few evaluation criteria. However, we propose an evaluation that involves different kind of evaluation categories to get an integral evaluation adding the possibility for evaluators to view evaluation indicators to guide them.

Additionally, the proposed knowledge management system could be an important contribution for e-leaning systems. Educators could make use of the information already existing and use the information that most interests them to structure their courses. Also, this proposal would help to promote a more in-depth reflection and evaluation of the syllabus by taking into account points of view related to searching and utilizing quality educational sources.

As a result, this proposal also could help students make use of quality content and activities by taking into account a variety of educational, curricular, technical and functional points of view.

These would in turn guarantee the establishment of an up-to-date knowledge-base that would be both suitable and reliable in accordance with the needs and requirements of learners.

In addition, feedback would assist in answering the questions about how to manage a growing e-learning information repository to meet the users' needs. Our future work is to implement this model in order to make possible adjustments and modifications.

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