Knowledge management system to re-feed learning objects repository

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As a consequence of Semantic Web, the kind of information to manage for knowledge management system is changing. Learning Objects (LOs) present advantages to be reused without interoperability problems to different contexts and platforms. However their content quality is not guarantee, for this reason an urgent necessity exists for a knowledge management system to evaluate and re-feed LOs to ensure their quality. According to this we suggest a system that promotes quality LOs management through a evaluation methodology that considers to re-feed learning objects repository, specially for e-learning system.

Keywords: Knowledge management; Learning objects

Como consecuencia de la Web Semántica, la información en sistemas de gestión del conocimiento (GC) está cambiando. Los objetos de aprendizaje presentan ventajas como la posibilidad de ser reutilizados sin problemas de interoperabilidad en diferentes contextos y plataformas. Sin embargo la calidad de su contenido no está garantizada, por esta razón existe una urgente necesidad para sistemas de GC de evaluar y realimentar objetos de aprendizaje para asegurar su calidad. De acuerdo a esto se sugiere un sistema que promueve la gestión de objetos de aprendizaje de calidad a través de una metodología que considera la realimentación de los objetos, especialmente para sistemas *e-learning*.

Palabras clave: Gestión del conocimiento; Objetos de aprendizaje

1. Introduction

One of the biggest challenges to KMS (Knowledge management systems) is the great importance that many organizations have given to obtaining information rather than to its retrieval. As a result, users face the problem of having large quantities of information and many difficulties retrieving the information they really need. Through an e-learning repository we can find a myriad of content from academic research and contributions, but how to guarantee and manage their content's quality?.

No 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 and platforms. 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.

The stage mentioned above 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. 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.

On this basis, section 2, presents general issues for LOs management. It includes subsection 3.1, which presents a subsystem to import learning objects from external sources, followed by our recommendation to normalize them 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. Knowledge management for learning objects

The first thing to take into account for knowledge management is to identify what to manage. Due to different kind of LOs definitions [3,6,7] we define them "as a unit with a learning objective, together with digital and independent capabilities containing one or a few related ideas and accessible through metadata to be reused in different contexts and platforms"[5].

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 [14]. On this basis, we will suggest how to manage LOs to support teachers decisions.

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. [11,12]. However, according to LOs and standards capabilities, it is necessary to consider how to manage quality LOs, taking into account their characteristics. Figure 1 presents a general view about the system we suggest to manage quality LOs. It system is divided in two sections.
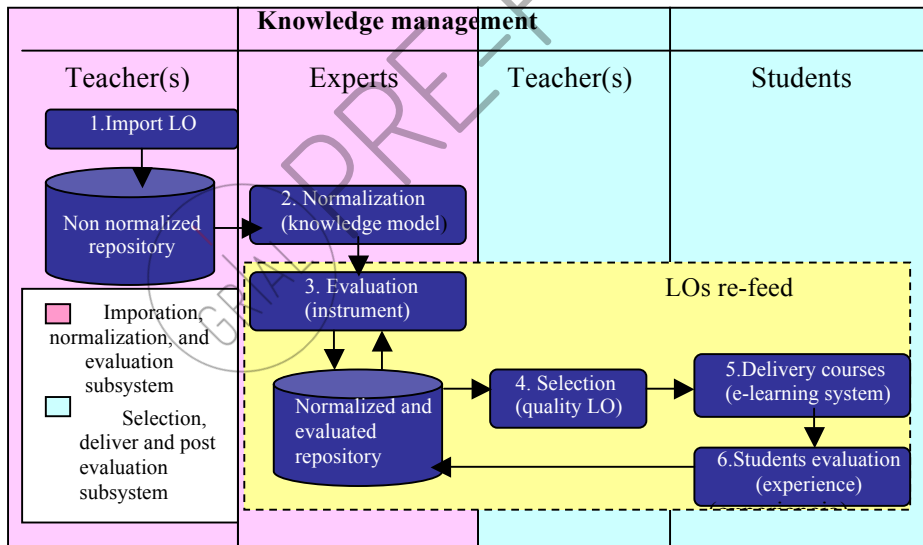

Figure 1. knowledge management system for quality LOs

3.1 Importation, normalization and evaluation subsystem

The possibility to import LOs enables to enrich a knowledge management system. Imported LOs may be selected with regard to context issues, such as, educational needs, priorities, expectations, etc. [13]. On this basis, some keywords may be used for searching LOs, like title, subject or author. In this way LOs searching could retrieve a variety of educational content.

However imported LOs must to be saved into a non-normalized repository because to ensure a uniform level of granularity they may be standardized. In this way it is possible to evaluate them with the same quality criteria. Therefore, the second step we suggest according to figure 1 is to normalize LOs according to a knowledge or ontological model through the following steps [4]:

1. Classify LOs objectives according to their complexity level, because in this manner it is more easy to know if the LO is suitable for new educational situations. We suggest Bloom's taxonomy [1], specifically cognitive domain.
2. To define the level of difficulty for each LO, we propose three kinds of complexity levels: basic, medium and advanced because this kind of clasification would help teachers to select the LO content according to their teaching objectives.
3. Classify LOs imported into three kind of content areas: data and concept, procedure or processes.
4. Reflection or attitude. This classification aims to define the kind of content according to the learning objectives. Nevertheless, LOs classification according to a knowledge model like this is not enough to guarantee the LOs quality.

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 [9].

To achieve an optimal LOs evaluation, it is necessary to consider quality criteria from different kinds of categories taking into account LOs metadata. In this way it is possible to consider different points of view with regard to the same object. According to this, we suggest an instrument which considers different evaluation criteria into four categories relating to IMS LOM educational category.

- Psychopedagogycal category: This category contains pedagogical criteria related to the psychology of learning. This kind of criteria aims to determine if the LO is suitable to promote learning, for example: learner's motivation. Metadata related: Intended End User Role, Typical Age Range, Difficulty.
- Didactic-curricular category: 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. Metadata related: Learning Resource Type, Context, Typical Learning Time, Description
- Technical- aesthetic category: Technical-aesthetic criteria are very important to making an integral LOs evaluation because in this way it is possible to know the efficiency of the LO. Standard compliance (suitable format), Metadata record (correct and complete information).
- Functional category: We relate LOs functionality with the following metadata: Interactivity Type, Interactivity Level, Semantic Density.

For getting the final result, we propose the following rating scale: 0 = Criteria is not present; 1 = Very low; 2 = Low; 3 = Medium, 4 = High, 5 = Very high.

According to [10] we suggest the participation of at least two participants from each area to encourages not only different points of view over the subject under evaluation, but also a critical objectivity and a reliable LOs evaluation.

To apply the instrument suggested above to value LOs, we propose two modes: individual and synchronic communication. According to this concept, individual evaluation provides an initial appreciation of the quality of the LO based on the judgment of each participant. 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 [10].

3.2   Selection, structuration and pos-evaluation subsystem

Once LOs evaluations are completed they will be saved on a normalized repository, as shown in the three 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. The process of structuration and pos-evaluation LOs is explained in details in figure 2.

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. Numerical ratings provided through the evaluations mentioned above allow quick comparisons for searching LOs. So teachers could to search LOs according to their quality level: high quality =5, good quality=4.

As figure 2 shows, LOs found may have a link that enable to see their quality evaluation into each one of categories, this issue aim to teachers to know more details that help them to decide if LO must be selected or not. As a result, it becomes easier to recognize which elements of the LOs 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 [2-6]. In this way, to complete a LO as a unit of learning and to compose didactic units (DU) with them, we think it is necessary to add other elements like this.

- **Overview:** According to Cisco Systems [2] and [6] a didactic unit needs a general vision in which may be explained general objectives and introduction about the LOs content.

- **Activities:** Activities may be directed to promote new knowledge acquisition and prepare users for a final assessment. Activities may be included into any kind of content during all teaching and learning process. They help users to know if they must to take the next lesson or a content feedback.

  According to this, to respond to different complexity levels contents and cognitive domains, we suggest taking into account three kinds of activities: Initiation, Restructuring and Application.

  Initiation activities classification may be for all LOs, which are designed to teach basic content for a specific subject. An example of this is a quiz. Restructuring activities classification may be directed to promote new knowledge acquisition, such as activities that promote questions, investigation, etc. Finally, applying classification activities may be directed to promote students' experience in order to achieve their new concepts acquisition. An example of this activity is a case study.

  To acquire new knowledge acquisition, it is advisable to propose activities at the end of a lesson, unit of learning or course. Due to LOs characteristics, didactic unit activities may be checked to avoid consistency problem with new LOs adaptation.

- **Summary:** As whatever kind of teaching and learning process, it is advisable a summary after contents review. For a suitable summary it is advisable to point out the principal ideas and relation between them, in this way it is possible to reinforce the contents and learner progress.

- **Assessment:** An evaluation must take into account each one of the learning objectives. For this reason we suggest to make a final evaluation taking into account each one of the LOs contents.

To reuse LOs avoiding interoperability problems, an educational modeling language is needed. We also suggest IMS Learning Design [8] because it has a flexible structure that supports pedagogical diversity. The classification provided by the knowledge model could help for this work.
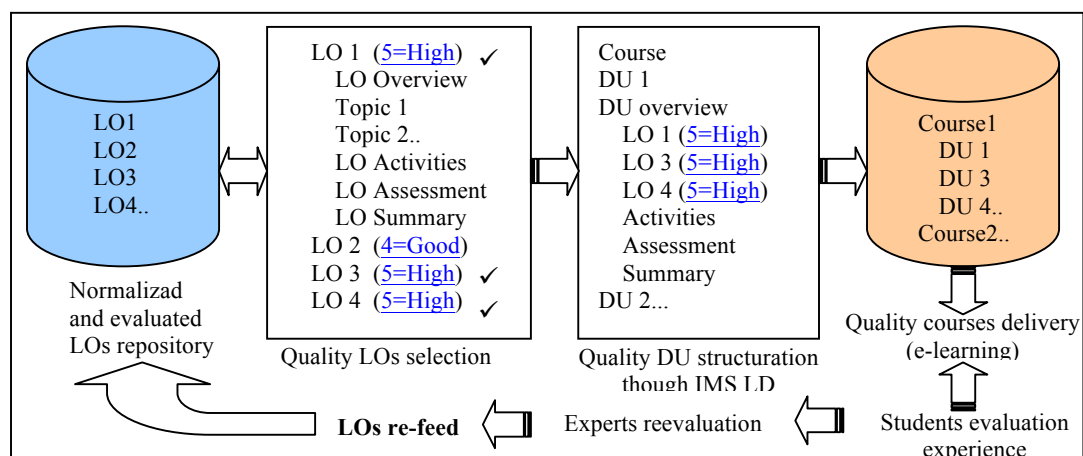
Figure 2. LOs re-feed into a knowledge management system

After quality courses delivery, it is recommended that users evaluate their quality taking into account their experience about the efficacy of the LOs to improve their quality. According to this experts may be a LOs reevaluation to evaluate their reusability and perform their quality for normalized and evaluated LOs repository. As Figure 2 shows, the re-feeding process is a cycle in which content is constantly evaluated for all subject experts and the e-learning users.

4. Conclusions and further work

The knowledge management system we propose could be an important contribution for e-leaning systems specially teachers and learners.

LOs content re-feed aim educators to 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, including the possibility to evaluate LOs according to a score weighting.

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