Enhancing Access to Learning Objects for Lifelong Learning

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Abstract: As Lifelong Learning includes informal and non-formal learning, it is important to give people the opportunity to have access to educational material, according to their interests. This paper presents VITAE, an application to help people find learning material to read, study, organize or share with others. It is based on Web 2.0 principles and has a simple interface so that it could be easily used by different types of users.

Keywords: Lifelong learning, learning objects, Web 2.0, social bookmarking

1. Introduction

Lifelong Learning (LLL) was defined as “all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal, civic, social and/or employment related perspective” (European Commission, 2008). Besides considering child, youth, adult and elderly education, LLL values all forms of learning: formal, informal and non-formal. In order to support the full meaning of LLL, it is important to provide educational material, so that people can easily find specific content that interests them.

These educational materials are usually known as learning objects (LOs). According to the IEEE, a learning object is “any entity, digital or non-digital, that may be used for learning, education or training” (LTSC, 2002). Traditionally, LOs are developed for the use of teachers, or as support materials related to specific courses. However, nothing prevents students or interested people from searching and using LOs by themselves.
LOs can be found in repositories like MERLOT\(^1\) and ARIADNE\(^2\). But they can also be found throughout the Web, in many different sites. For example, there are sites that offer downloadable or on-line courses, like BBC languages\(^3\) and University of the Third Age\(^4\). Then, there are many options to find LOs. In spite of that, it is not always easy to find them (Coelho et al., 2008). This paper presents VITAE (Virtual and Interesting Teaching and learning material for Always and Ever) a proposal of a new Web service that aims to enhance the ability of users to find what they want to learn.

This paper is structured as follows. Section 2 links Web 2.0 to LLL. Sections 3 and 4 present the architecture of VITAE and its main functionalities. Section 5 discusses related work. Finally, Section 6 presents our conclusions and suggestions for future work.

2. Web 2.0 and Lifelong Learning

Web 2.0 is not a new technology, but simply a change in the way we see and use the web: “the Web as a platform” (O’Reilly, 2005). In the Web 2.0, users participate and collaborate more. When they want to participate, they do not have to install specific software in their computers, but just enter a Web site. Some well known Web 2.0 site examples are: YouTube\(^5\), del.icio.us\(^6\), flickr\(^7\) and Wikipedia\(^8\).

In the following subsections, we present some Web 2.0 principles (O’Reilly, 2005) and discuss how they impact or bring benefits to LLL.

2.1 User generated content

With the Web 2.0, users can easily create and upload many different types of materials: videos, animations, graphics, texts, sites and so on. According to information available on youtube.com\(^9\), people are “uploading hundreds of thousands of videos daily. In fact, every minute, ten hours of video are uploaded to YouTube". The English version of Wikipedia already has 2,664,988 articles\(^10\).

\(^{1}\) http://www.merlot.org  
\(^{2}\) http://ariadne.cs.kuleuven.be  
\(^{3}\) http://www.bbc.co.uk/languages/  
\(^{4}\) http://onlinecourses.u3a.org.uk/  
\(^{5}\) http://www.youtube.com/  
\(^{6}\) http://delicious.com/  
\(^{7}\) http://flickr.com/  
\(^{8}\) http://www.wikipedia.org/  
\(^{9}\) http://www.youtube.com/t/fact_sheet  
\(^{10}\) http://en.wikipedia.org/wiki/Main_Page
These two examples show the potential of the Web 2.0 as a tool to save, organize and share learning content that interests a user. In the educational context, the issue raised by this principle is the confidence that the apprentice may have with the quality, relevance and adequacy of the material he/she access. This issue is addressed by the next Web 2.0 principle: “harnessing collective intelligence”.

2.2 Harnessing collective intelligence

The idea behind this principle is to enhance the power or wisdom of the crowds: “the ‘crowd’ is more likely to come up with the ‘right answer’, in certain situations, than any one individual” (Anderson, 2007). That is why so many Web 2.0 sites offer users, the option to evaluate the material they have accessed. This principle helps Web 2.0 to maintain the quality of the materials it provides. Or, at least, it allows users to evaluate and have access to the evaluation of others.

2.3 The long tail

The Web follows a power law distribution. In other words, it has many dispersed sites with contents that are not of interest to many users. This set of sites form a long tail. However, collectively this long tail still attracts a large amount of users due to its variety of subjects (Anderson, 2007).

In the educational context, this principle represents many more options of topics to learn. For example, we can think of topics for small audiences, or communities like Arabian courses, in spite of English courses. Recipes of exotic dishes are another example.

2.4 The architecture of participation

The idea behind this principle is that “the service automatically gets better the more people use it” (O’Reilly, 2005). It works along with the previous principles: as more people use the service, more material will be uploaded and more evaluations will exist. However, this depends on the cooperation of users.

3. A Proposal of a LO Retrieval System

Xu et al. show that the use folksonomy tools to search content on the Web may achieve better results than traditional Web search mechanisms (Xu et al., 2008). Empirical studies done by Coelho et al. confirmed the advantages of the Web 2.0 retrieval tools in relation to traditional search tools in the context of learning
objects (Coelho et al., 2008). These results led to the development of a LO retrieval tool based on the principles of Web 2.0. It is important to remember that the principles of Web 2.0 increase the involvement of users (Monge et al., 2008). Therefore, repositories or LO bases become more accessible for teaching and learning through the use of tags and social software (Franklin & Harmelen, 2007).

Among the options of Web 2.0 applications, the model of social bookmarking stands out because it offers facilities to store links of content selected by users, share these links and classify them using tags. In the social bookmarking process, users attach tags or an informal vocabulary to digital content, showing their vision of the content, which can be a bookmark of a third party. This can be used to help the system organize the knowledge.

Social bookmarking tools are simple, intuitive and are already known by many Web users. Moreover, social bookmarks are open in the sense that any user can post links, without restrictions, unlike the repositories. These reasons contributed to our decision of proposing the development of a mechanism for LO retrieval based on Web 2.0 principles or, more specifically, a social bookmarking tool focused on the recovery of LOs.

### 3.1 Main System Requirements

In order to elicit the requirements of a LO retrieval system, we did some case studies of social bookmarking applications available on the Web. The social bookmarks considered were: delicious\(^{11}\), furl\(^{12}\), Connotea\(^{13}\), gennio\(^{14}\), Webgenio\(^{15}\) and citeulike\(^{16}\). In all of them, we observed the use of tags for indexing and searching links. Tags can contribute to achieve better search results, because they can be used to filter results.

In our studies we have found that, in spite of being a Web 2.0 principle, the analyzed social bookmarks have no resources that allow users to evaluate the links.

From our studies, and considering Web 2.0 principles, we have specified a requirements list for a social bookmarking tool:

1. Storage of links to LOs, with their related tags;
2. Search for links to LOs through keywords (tags) and age range;
3. User evaluation of links to LOs, which can be used in the ranking of results from searches;

\(^{11}\) [http://del.icio.us](http://del.icio.us)
\(^{12}\) [http://www.furl.net](http://www.furl.net)
\(^{13}\) [http://www.connotea.org](http://www.connotea.org)
\(^{14}\) [http://gennio.com](http://gennio.com)
\(^{15}\) [http://webgenio.com](http://webgenio.com)
\(^{16}\) [http://www.citeulike.org](http://www.citeulike.org)
4. Creation of user accounts, so that they can post their favorite links to LOs;
5. Organization of tags added by users (changing and renaming).
This list was considered in the design of our proposal.

4. VITAE

VITAE is an acronym for Virtual and Interesting Teaching and learning material for Always and Ever. It is a social bookmarking tool aiming to facilitate the search and retrieval of LOs. The search for LOs begins at the user's computer. Through the browser, the user accesses VITAE (Figure 1). In VITAE, users can type keywords that represent their needs. The system will search through all the tags it has stored to see if any of the tags matches the keywords typed. It returns a list of LO links of whose tags match completely or partially the keywords searched. The list is ranked by the evaluation of other users. The links of LOs that received the best evaluations will appear in the top positions of the ranking.

![Bookmarking Social VITAE](image)

Figure 1 VITAE: initial screen

As in other Web 2.0 applications, users are responsible for all activities: link feeding, tagging and evaluating. Figure 2 shows the screen for link insertion, where users can post their favorite links to LOs and include tags associated to these LOs. When including a link, it is interesting to specify the suggested age range for using the corresponding LO: children, adults or elders. This information can help save the time of many users in the choice of search criteria by LOs.
Figure 2 VITAE: links insertion

Each of the inserted links can be evaluated by other users. This evaluation approach follows the LORI method (Nesbit et al., 2003), which suggests 9 evaluation criteria with grades varying from 1 to 5. LORI was chosen due to its breadth, besides the fact that it has become a reference model in the literature.

VITAE uses 5 out of the 9 criteria suggested by LORI:
1. Content quality – the LO’s content is complete by itself and does not present errors;
2. Learning goal alignment – the LO has a well established pedagogical goal that can be achieved through its use;
3. Feedback – the LO presents feedback to its users during interactions;
4. Motivation – the LO has motivational elements;
5. Reusability – the LO can be easily transferred to different courses and contexts without requiring changes.

The other evaluation criteria from LORI were not considered in VITAE because they were not adequate to VITAE’s evaluation goal. The criteria “presentation design” and “interaction usability” are difficult to be analyzed by naïve users. The criteria “standard compliance” and “accessibility” were not considered because of the difficulty to find LOs that conform to these criteria.

The final grade of the LO in each evaluation criterion is given by the average of all users in that specific criterion. LOs are considered to be relevant or to have...
good quality if they receive a final grade greater than or equals to 3 in at least 3 out of the 5 criteria. Otherwise they are considered partially relevant. LOs that receive zero in 3 out of the 5 criteria are considered low quality LOs.

These evaluation final grades are also considered by the algorithm that ranks the search results. The ranking process follows the FolkRank algorithm (Hotho et al., 2006). It classifies the search results according to its relevance to the users. In other words, it ranks the LOs according to the evaluation grades of LOs in the moment of the search.

It is also important to notice that VITAE interface is very simple and clean, so that it could be easily used by children, elders and naive computer users.

4.1 Architecture and Implementation

VITAE was developed on Ruby on Rails. Ruby is an object-oriented programming language with dynamic typing, suitable for the development of Web applications (Thomas & Hunt, 2000). Rails is a framework for the development of applications in Ruby which focuses on the MVC (model-view-controller) architectural pattern. The combination Ruby on Rails allows a high productivity, making the development of Web applications faster and easier.

Figure 3 shows the architecture of the proposed social bookmarking tool. On the client, the browser executes the part of the application that matches the vision of the MVC. The vision uses: HTML for presentation in the browser, Cascading Style Sheets (CSS) to define the style of vision, Ajax to avoid complete reload of pages with minor changes and the JavaScript language to dynamically compose the pages displayed to the end user.

On the server, the application has a controller written in Ruby and a data model based on the framework ActiveRecord, which is part of the Rails. The controller is responsible for handling requests made by the user and the data model is responsible for describing the relations between classes so that the ActiveRecord can make the object-relational mapping for the server database. This database stores information from users, links to LOs and tags attached to these links. The LOs remain stored only in their original source.

When a user searches for a LO, he/she types the desired keywords which will be matched with the associated tags of the stored LOs. The search engine translates the keywords in the form of SQL queries for the database. The database application returns the links to LOs whose tags matched the keywords specified by the user, in the search.

The first prototype of this tool is now implemented and the next step is to populate the database with a starting set of LOs so that it can be released to the general public. We plan then to collect data on the usage to verify our assumption that this social bookmarking tool is a better solution to retrieve LOs.
5. Related Work

As previously reported in the introduction of this paper, repositories are an option to retrieve LOs. However, they have the following disadvantages:

- In general, they are closed. In other words, only LOs approved by its committees are published. This can restrict the number of available LOs. For example, the Brazilian portal OE3\textsuperscript{17}, provides only 74 LOs.
- Some of them address few areas of knowledge. For example, the portal OE3 presents content restricted to the theme of engineering structures. The portal EduKbr\textsuperscript{18} does not address mathematics and engineering.

Another option is the search engines, like Google that help users find information published on the Web. However, the results presented by the search engines show large amounts of information that make it difficult for the users to identify and select materials that are really relevant to their needs (Coelho et al., 2008). Coelho et al. showed that, in the search for LOs or repositories, search engines return a lot of information about the concept of learning objects or repositories, but they did not return the links to LOs in the first page of results. LOs that are stored in repositories are even more difficult to be found, because the machines do not return links to them in the top positions (1st to 10th position).

\textsuperscript{17} http://www.cesec.ufpr.br/etools/oe3/
\textsuperscript{18} http://www.edukbr.com.br/profsonline/index.asp

Figure 3 VITAE architecture
As discussed in Section 2, Web 2.0 offers many positive characteristics and possibilities to improve LOs retrieval. There are already a great number of available tools: citeulike\(^{19}\), connotea\(^{20}\), kratia\(^{21}\), delicious\(^{22}\), YouTube\(^{23}\), TeacherTube\(^{24}\).

Citeulike and connotea are social bookmarking tools restricted to scientific and technical papers.

Kratia is a search engine that, based on the principles of the Web 2.0, allows users to evaluate the results. However, it does not allow users to save their favorite links.

Delicious is one of the most known social bookmarking tools (Hammond et. al, 2005). Its popularity is due to the involvement of users in the selection and inclusion of links on the site. However, it accepts links to various types of materials and subjects, from scientific and technical papers to links to sites of underwear. So, people can have some difficulties to find specific material for learning purposes.

Youtube is another very popular Web 2.0 service. However, besides restricting its links to videos, it offers the same subject diversity of Delicious. It is important to make clear that subject diversity is an advantage only when it is also associated with specific goals. In YouTube, we can find a lot of videos that just aim to be funny or to promote people, like unknown artists.

Focusing on educational material, TeacherTube was created on 2007. Like Youtube, the idea is to facilitate video sharing, but it restricts the service to instructional videos. However, videos are not the only interesting material to be used in the learning process.

6. Conclusions and Future Work

There is the need to facilitate the access to LOs, in order to give a support to LLL. There are already many tools that could be used for that. However, as discussed in Section 5, all of them have their restrictions and negative aspects. Therefore, we have proposed another Web 2.0 tool that combines the advantages of Delicious and TeacherTube, and also incorporates the LORI evaluation criteria (Nesbit et. al, 2003).

As future work, we propose the improvement of VITAE and offering it to the Web community. Due to the simplicity of its interface, VITAE can be easily adapted to many devices, like mobile phones and palms.

\footnotesize{\textsuperscript{19} http://www.citeulike.org
\textsuperscript{20} http://www.connotea.org
\textsuperscript{21} http://www.kratia.com/
\textsuperscript{22} http://del.icio.us
\textsuperscript{23} http://www.youtube.com/
\textsuperscript{24} http://www.teachertube.com/}
We expect that it will bring many contributions to society, making educational material available for people of different ages and interests.

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