Providing Culturally Contextualized Metadata to Promote Sharing and Reuse of Learning Objects

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ABSTRACT
This paper presents some proposals to formalize the creation of Learning Objects (LO) that define rules concerned to the content organization and/or the set of metadata used to describe and to document the LOs. This paper presents Cognitor (COGNItive strategies-based EdiTORS), a common-sense aided framework for a certain Pattern Language that aims to help educators create and contextualize e-Learning content as hyper documents, considering cognitive, pedagogical and cultural issues, packaging the LOs according to SCORM (Sharable Content Object Reference Model) standard, the most known and probably most used standard for LO creation. The LOs created by Cognitor are intended to be easy to share and reuse, mainly because Cognitor helps editors fill out the LO metadata using concepts that are culturally contextualized on the main target learner’s culture through suggestions coming from a common sense knowledge base that are used to support filling in specific metadata fields.

Categories and Subject Descriptors
K.3.1 Computer Uses in Education
H.5.2 User Interfaces

General Terms
Design, Documentation, Human Factors, Standardization.

Keywords
Learning Object, Metadata, Reuse, Framework, Common Sense, SCORM.

1. INTRODUCTION
Developing educational content for e-Learning can be a difficult task for educators, especially for those who lacks experience on computer aided education, what requires time, resources and skills which are still often unknown. Such difficulties can lead to Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

There are tools [7], [8], [14] for electronic content creation, but the possibility of reuse generated materials is an issue, once few of these tools [9], [21] allow the content to be properly identified in order to share and reuse it, and most of the times, the support for content documentation is poor. The challenge is how to transform the content into a LO, a digital entity that can be used, re-used, referred by or compose other LO, having relevant metadata describing it properly. Metadata are assumed here as data or information that describe and identify properly the LOs, and how those metadata are filled out is the biggest issue, being the key to allow (or not) the share and reuse of the LOs. In this work, the creation of LOs is based on SCORM [19] proposal, which uses the IEEE LOM (Learning Object Metadata) standard [12] to organize the LOs’ metadata.

Aiming to facilitate the task of filling out such metadata with meaningful and contextualized information, it is presented Cognitor, a framework that allows content packaging according to SCORM [19]. Cognitor uses common sense knowledge from the OpenMind CommonSense-Brasil Project (OMCS-Br) knowledge base to support the process of filling out metadata in such way that the packaged LO can be labeled according to the learner’s culture, facilitating the appropriate reuse and sharing of the generated LO. As a proof of concept, the tool uses common sense knowledge to fill out the keywrd metadata field, as explained in the paper. The concept of common sense adopted in this work is defined by Lenat [16] as "the knowledge shared and accepted as true within a social community, spanning several knowledge categories such as temporal, spatial, social, cultural and so forth".

In a broader view, Cognitor is an editor and media aggregator that aims to support a Pattern Language called Cog-Learn, which was designed to help educators to develop content according to the concept of cognitive strategies from Gagné [11], and pedagogically suited to the learner’s cultural profile [1]. The study presented here points out to other metadata fields from
IEEE LOM [12] that can be filled out with the common sense support.

This paper is organized as follows: section 2 explains what are LOs; section 3 presents Cognitor; section 4 introduces the metadata concept; section 5 shows how the metadata are used by Cognitor, how these metadata are contextualized, how other metadata fields can be supported in their fill out with the common sense knowledge, some user interface prototypes and a experiment showing if the created prototypes are valid; section 6 presents the results related to the experiment exposed in section 5; finally, section 7 presents the conclusions and points some future works concerning the tool.

2. LEARNING OBJECTS

LOs are defined by IEEE LTSC (Learning Standards Technology Committee) [12] as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. The creation of a LO involves two aspects: the creation of the educational content and the process of filling out its metadata. Since the material is filled out with metadata, it becomes a LO that can be identified through its metadata fields, allowing to recover and reuse the LO efficiently.

There are many standards that formalize the creation of LOs, dictating rules that concern the content organization and/or the set of metadata fields used to describe and to document the LO. Examples of some standards that can be cited are:

- **IEEE LOM** [12] – The IEEE LOM (Learning Object Metadata) standard, formally IEEE 1484.12.1-2002, is a standard that specifies a set of metadata fields responsible for describe the characteristics related to the LO purpose. This standard was created in order to be adopted as a model to other metadata standard proposals.

- **IMS** [13] – The IMS is not properly a metadata standard, but a set of best practices that describe how an application should implement and/or manage the IEEE LOM standard.

- **CanCore** [3] – Like IMS, the CanCore Initiative is not a metadata standard, although it is concerned in explain how the IEEE LOM metadata fields should be properly used, i.e., CanCore provides detailed explanations about each IEEE LOM metadata fields.

- **Dublin Core** [10] – The Dublin Core is a set of fifteen properties used to describe resources. Unlike IEEE LOM, that has a set of more than 50 metadata fields, Dublin Core metadata set is smaller and more concise than IEEE LOM.

- **SCORM** [19] – The SCORM (Shareable Content Object Reference Model) standard is a set of specifications that dictate how a LO content and metadata should be organized and packaged. SCORM uses the IEEE LOM metadata standard to describe and document the LOs’ content.

Some standards try to formalize how the LO’s content and metadata should be organized. While Dublin Core is a small and concise set of metadata fields, IEEE LOM is a full set of fields that tries to describe all the relevant characteristics of a LO content.

Cognitor adopts the SCORM standard to do the packaging of the educational content and to describe it through its metadata. The SCORM standard was chosen because it is composed by many specifications that formalize not only the metadata fields, but also all the other aspects related to LO, like its packaging and execution procedures in different Learning Management Systems (LMS) that implement the SCORM Runtime Environment. To understand how the metadata play an important role in LO creation, it is necessary to understand what metadata are and how they can contribute to the use, retrieval and reuse of the LOs. Next section presents Cognitor as a tool for electronic content creation as a SCORM LO.

3. COGNITOR

Cognitor is an authoring tool, or a media aggregator, that supports a Pattern Language called Cog-Learn [20]. It was designed to help educators in designing and editing quality learning material to be delivered electronically to learners. Cognitor was created to facilitate the development of accessible and usable learning content, using common sense knowledge in order to support the contextualization of such learning content to the learners’ needs [5][6]. Figure 1 shows the Cognitor’s main interface that is composed by six areas [1]:

![Cognitor's main interface](image)

Figure 1. Cognitor’s main interface (based on [1]).

1. **Planning and Organization Area** – Using the options of this area, editors can define a new organization (structure and sequence of pages and topics) for the learning content or change an structure that was previously created. Cognitor also offers the possibility of using the common sense knowledge to help them to build the content organization, following a certain pattern from Cog-Learn.

2. **Media Insertion and Content Publication Toolbars** – The media insertion and content publication toolbars allow the inclusion of media objects such as audio, video and images. Furthermore they make possible to manipulate actions performed during the object creation/editing, such as redo, undo, cut, past, copy, find and replace. Editors can also save their content using the functionalities available in this area and export them in SCORM [19] or HTML format too.
3. **Page Edition Area** – In this area, editors can see the contents that are under edition and also insert new content, media or even another LO. There they can edit the bodies of the pages that compose the content, typing text or inserting several different media through the Media Insertion and Content Publication Toolbars.

4. **Interaction Design Area** – In this area, the editor can create a page template to apply on the material as a whole. The idea of configuring the initial environment class corresponds to solutions for common problems found in HCI analysis context which were formalized as Patterns that compose the Cog-Learn Pattern Language [20].

5. **Media Properties** - This area allows to change the properties – height, weight, colors, fonts, etc – concerning to each type of media inserted in the Page Edition Area.

6. **Object Control Area** - This area displays a list of the objects used in the page that is being edited, enabling the change of their order and allowing the metadata filling out of the selected object. As cited, the metadata are important to describe the properties and behavior of each object inserted into a page and, in this way, they make possible to know, for instance, the objective of the insertion of a certain picture in the LO and the data about the author of the picture.

There are several other tools that are capable of create LOs, and a comparison table is showed in Table 1. This comparison was based on the features that W3C recommends for Web page authoring tools [1].

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Own Editor</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Add Resources</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Export HTML</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Collaborative</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Concept Map</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Add Creation of Concepts</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Metadata</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Common sense support</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

The most important characteristic concerned with this work is the support that each tool gives to the LOs metadata fill out. As can be noticed in Table 1, 50% of the tools offer support on filling out metadata and one of these tools is Cognitor.

4. **METADATA - CONCEPT AND IMPORTANCE**

Metadata means data about other data and according to Keleberda et al. [15] they are one of the most important components of a LO. The metadata fields are important because they enable users to find relevant resources (when they were filled out with metadata), and in a learning context, if the user is unable to find an educational resource, this resource cannot be reused and the concept of reusable LO does not work [18]. As cited in the previous section, 50% of the tools that were analyzed support the metadata fill out, so these tools are able to create LOs, and it is very important, because the purpose of a LO is to be a reusable content, and this reusability is achieved through the metadata.

Thus the educational content must to be filled out with significant metadata to become a reusable LO. However, the data used to fill out the metadata fields need to be contextualized according to the LO content and to the learners’ culture in order to create valuable search results for them. The next section shows how Cognitor deals with the metadata.

5. **FILLING OUT METADATA ON COGNITOR**

As cited in Section 3, Cognitor is capable of supporting the task of filling out metadata for the LOs created and these metadata take into consideration IEEE LOM [12] standard. Some metadata fields, such as title and description are already filled out semi-automatically by the current version of the tool [4]. Title is filled out with the name of the LO under edition, while description is formed from concept map relations created during the edition of the material. Figure 2 shows the Cognitor’s metadata editor with title and description metadata fields filled out.

On the left side of the Figure 2, it is presented a tree that organizes the content pages, while the right side of the window displays all the IEEE LOM metadata fields that can be filled out to each content page. In this example, the metadata of Jaguar page is being edited. As it can be seen, the title field is filled out with the page name, while the description field is filled out with the relations that exist among the Jaguar page and the other pages that compose the educational material. The next subsection shows how the keyword field is supported by the common sense knowledge.

5.1 **CONTEXTUALIZING METADATA ON THE LO’S LEARNERS CULTURE**

The support of contextualized metadata fill out can be achieved using the common sense knowledge provided by the OMCS-Br Project. This project aims to collect common sense facts of the
Brazilian population in order to be applied to the development of contextualized computer applications.

Nowadays, Cognitor’s metadata editor provides to the users a support to fill out the keyword field using suggestions that come from the common sense knowledge base, as it is showed in Figure 3.

![Figure 3. Cognitor’s keyword composer.](image)

The region 4 of Figure 3 shows the creation of a keyword list. The region 1 shows a list of words that were mined from the content using some summarization algorithm. At this moment, it is a simple algorithm that ranks the words according to the number of times it appears in the text, but can be replaced by any other more intelligent algorithm to extract the most significant words from the content. Using the list showed in region 1, the user can select a word and add such word to the keyword list in region 4 (by clicking on the vertical arrow between both regions) and also search in the common sense knowledge base for concepts related to that selected word (by clicking the button Search >>).

In the example, it can be seen that the editor selected the concept health – region 1 – and after the selection, s/he clicked on the Search >> button. By doing this, a search query is sent to the common sense knowledge server and the server returns a list of concepts related to the word health. The search results are presented in the middle list, highlighted by region 2. Observing the list with suggestions from common sense, the editor of the content can select a concept from that suggestions that can remind the learners what that LO is about, although the word is not in the text, but is a word related to the learner’s vocabulary and culture about the theme. Then, the editor can click on the vertical arrow under region 2 and the word from common sense is inserted in the keywords list. This procedure can help the reuse of the LO, once it potentially makes the keyword metadata field more meaningful to the potential users of that LO.

If the content editor wants to use a concept that was not presented neither in region 1 list nor in region 2 list, s/he can type a concept in the third list (region 3) and add the word to the keyword list. By doing this, the editor also is able to perform a search in the common sense knowledge base in the same way s/he did for the concepts on the first list. To create the keyword list, the editor also can simply edit the keyword text field highlighted by region 4. As already said, to use concepts that are in one of the tree lists, the content editor needs to select the desired concept and clicks on the button with a low arrow that corresponds to the lists that s/he chose.

The use of the common sense knowledge suggestions intends to help the educator, i.e., the editor of the content, on contextualize the metadata in the learner’s culture, aiming to better document the edited LOs, facilitating the LOs’ understanding in order to promote their reuse. It is important to observe that this study is instantiated in Brazilian culture and that the content of the common sense knowledge base is composed by concepts in Brazilian Portuguese. The examples listed in Figure 3 were freely translated from Brazilian Portuguese to English.

At this time, only the keyword field has the common sense support to be filled out. However the next subsection proposes a subset of the IEEE LOM metadata fields that can be supported by common sense knowledge to be filled out by content editors using Cognitor.

### 5.2 POTENTIAL METADATA FIELDS TO BE SUPPORTED BY COMMON SENSE

This work proposes the implementation of the common sense support in other metadata fields besides the keyword field. Table 2 shows the IEEE LOM metadata fields that can be filled out with support of common sense suggestions.

<table>
<thead>
<tr>
<th>Category</th>
<th>Field</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>description</td>
<td>Represents a textual description of the LO being described by the metadata. The description element allows for a narrative description of the component.</td>
</tr>
<tr>
<td></td>
<td>keyword *</td>
<td>The keyword element shall be used to define common keywords or phrases that describe the learning object. The keyword element consists of one word or phrase.</td>
</tr>
<tr>
<td></td>
<td>coverage</td>
<td>This element shall be used to describe the time, culture, geography or region to which the LO applies.</td>
</tr>
<tr>
<td>Life Cycle</td>
<td>description</td>
<td>A textual description of the date related to the contribution made by the entity.</td>
</tr>
<tr>
<td>Meta-Metadata</td>
<td>contribute /</td>
<td>A textual description of the date related to the contribution made by the entity.</td>
</tr>
<tr>
<td></td>
<td>date /</td>
<td></td>
</tr>
<tr>
<td></td>
<td>description **</td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>installation</td>
<td>This element is used to represent any specific instructions on how to install the LO. This element could be used to describe to the user of the component any remarks.</td>
</tr>
<tr>
<td></td>
<td>Remarks</td>
<td></td>
</tr>
</tbody>
</table>
The current development cycle of Cognitor intends to improve the metadata editor, to implement all of those common sense related features and provide to the tool the characteristic of a Web application. The next section will show some metadata editor prototypes for the tool’s new version.

5.3 USER INTERFACE PROTOTYPES TO FILL OUT METADATA ON CONGNITOR

For the Cognitor’s new version, which will be developed as a Web application, there are changes in user interface aiming to improve the user experience. The Figure 4 shows the new metadata editor for Cognitor that is being built to be compatible with IEEE LOM and SCORM 1.4.

As can be observed in Table 2, all the metadata fields that were chosen to be supported by common sense knowledge are fields that shall be used to create a textual description of some characteristic of the LO. The common sense can help to fill out these fields because using the knowledge base, the editor is able to create more understandable concept descriptions for the learners, considering their previous knowledge, their context, their culture, their common sense.

---

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>otherPlatform Requirements</td>
<td>This element is used to represent information about other software and hardware requirements of LO. This element should be used to describe requirements that cannot be represented or expressed with the other technical elements.</td>
</tr>
<tr>
<td>duration / description **</td>
<td>Used to describe the duration element.</td>
</tr>
<tr>
<td>Educational description</td>
<td>This element shall be used to comment on how the LO is to be used.</td>
</tr>
<tr>
<td>Rights description</td>
<td>This element allows for comments on the conditions of use of the LO. This element can be used to describe any cost, copyright or other restrictions about the LO.</td>
</tr>
<tr>
<td>Relation resource / description **</td>
<td>This element describes the target LO.</td>
</tr>
<tr>
<td>Annotation date / description **</td>
<td>This element shall be used to describe what was done in a particular date.</td>
</tr>
<tr>
<td>Annotation description</td>
<td>This element shall be used to represent the contents of the annotation.</td>
</tr>
<tr>
<td>Classification description</td>
<td>This element contains a description of the LO relative to the stated purpose of the specific classification, such as discipline, idea, skill level, educational objective, etc.</td>
</tr>
<tr>
<td>Classification keyword</td>
<td>This element contains keywords and phrases descriptive of the LO relative to the stated purpose of this specific classification, such as discipline, idea, skill level, educational objective, etc.</td>
</tr>
</tbody>
</table>

* already has common sense support
** the notation “field1 / field2 / fieldN” means that field1 is composed by parts and field2 is one of them.

This new version of the metadata editor organizes the nine categories of the IEEE LOM metadata fields in tabs, aiming to facilitate their fill out. The tabs are highlighted in the top of Figure 4. In this example, the General category fields of the Jaguar page are being edited.

The common sense support for the description, keyword and coverage fields can be accessed through the buttons displayed in front of each metadata field as it can be seen in Figure 5. It is important to emphasize that the common sense support button is presented in front of each one of the metadata fields explained in Table 2. These buttons use the OMCS-Br logo as an icon.

![Figure 4. New interface of Cognitor’s metadata editor.](image)

![Figure 5. Common sense support buttons of Cognitor’s new metadata editor.](image)
As cited, the Common Sense Support window, showed in Figure 6, allows the content editor to search the common sense knowledge base. For that, the editor should fill in the text field named Concept and choose what type of relation the concept being searched has to have with the concepts being retrieved from the knowledge base. The relations currently available are: is a, has the property(ies), its parts are, is made of, is defined as, is capable of, it is find at, has the desire of, is used for, is motivated by, is a prerequisite of, is a post requisite of, has a relation with, according to Minsky’s proposal to model the human knowledge [17] and adopted on the OMCS-Br project. As an example, Figure 7 shows the use of the Common Sense Support window.

In the example presented in Figure 7, it is showed a search related to the concept ball, and the desired results are the properties of a ball. As results of the search, it is shown the concepts spherical, round, colored, light, full and heavy. Again, these results were freely translated from Brazilian Portuguese to English.

The Common Sense Support window is designed to be a user (content editor) helper, an assistant that makes searches in the knowledge base. The user can move the window to wherever s/he wants, since the window is inside his/her browser window bounds. The Figure 8 shows a browser window that is running the metadata editor prototype. The left side shows the metadata editor, while the right side shows the Common Sense Support window.

5.4 FIRST EXPERIMENT

To validate the changes made in Cognitor’s metadata editor, it was conducted an experiment composed by three parts. In the first one, it was presented to the users (3 users, individually) the current version of Cognitor’s metadata editor (Figure 2). They were asked to use the editor and to check if it was useful and easy to use. Besides the use of metadata editor, the users were asked to use the keyword composer (Figure 3) and to think if its user interface was easy to use and understand.

In the second part of the experiment, it was showed to the users the prototype of the new metadata editor (Figure 4). As in the first part of the experiment, they were asked to use the editor and to think if it was useful and easy to use. They were able to use the Common Sense Support window (Figure 6) too.

The third and final part of the experiment was composed by a questionnaire that had five questions:

1. You think that the use common sense to support metadata edition is:
   ( ) Very useful   ( ) Useful   ( ) Indifferent
   ( ) Little useful   ( ) Useless

2. Have you had any difficulties to use the current version of Cognitor’s metadata editor? Why?
   ( ) Yes   ( ) No

3. Has the split of the metadata's categories in tabs contributed for a better organization of the metadata's editor? Why?
   ( ) Yes   ( ) No

4. Did you think that the use of the Common Sense Support window has simplified the retrieval and use of
common sense suggestions in order to facilitate the metadata’s contextualization? Why?

( ) Yes   ( ) No

5. Do you have any comments about how the user interface prototypes could be improved?

Using the answers collected from users using this questionnaire, it was possible to conclude some points. The next section summarizes the results obtained through the use of the questionnaires and the observations of user interaction with the current version of Cognitor’s metadata editor and the prototypes for the new version.

6. RESULTS

Two of the three tested users (67%) reported that the use of common sense is very useful in the support of metadata edition, while the remaining user (33%) said that this common sense support is useful.

All the users (100%) said that they had difficulties while using the current version of Cognitor’s metadata editor (Figure 2). The main difficulties were related to the lack of organization of the metadata categories and the lack of information in explaining to the user what the purposes of each metadata field are. The use of tabs to organize the metadata categories was pointed by all the users (100%) like a useful feature, because they thought that using tabs, the fields have become more organized and easy to find.

All the users (100%) reported that the Common Sense Support window (Figure 6) simplified the way that the common sense is retrieved and used. They said that the option to filter the results using a relation is a good feature. They also reported that this window is simpler to use than the Cognitor’s keyword composer (Figure 3) and that it can be used to support the fill out of other metadata fields than the keyword field.

As suggestions, the users proposed the inclusion of a way to help the users to understand the purpose of each metadata field, and a button in the Common Sense Support window used to copy the selected concepts that were retrieved to the corresponding metadata field in the metadata editor. These changes are showed in Figure 9 and Figure 10.

Figure 9. Tooltips to explain the purpose of the metadata fields.

The Figure 9 shows the feature that helps the users understand the purpose of each metadata field. This feature was implemented like a tooltip for each metadata field. In the example, there is a tooltip that describes the description metadata field.

Figure 10. The copy to field button of the Common Sense Support window.

The copy to field button was inserted in the Common Sense Support window (Figure 10) to help the users copy the chosen concepts to the respective field in the metadata editor.

As it has been showed, all the users’ suggestions were considered. These changes were not validated yet, but they will be validated in a new experiment to find out if the changes contributed to simplify Cognitor’s metadata fill out feature, considering usability and accessibility aspects. The next section exposes the conclusions of this work.

7. CONCLUSION

This work emphasized that the use of the common sense knowledge allows the contextualization of the LO’s metadata, i.e., the creation of metadata related to the cultural background of the target’s audience, aiming to improve the reuse of the LOs. To make it possible it is necessary to create a new version of the tool which will be a Web application, once the current version is a standalone desktop application, and to make the LOs created by Cognitor more reusable they need to be available in the Web environment.

The first step in the creation of the tool’s Web version was the development of some user interface prototypes related to the LO’s metadata fill out. To evaluate these prototypes, an experiment was conducted aiming to evaluate if the Web version would be easier to use than the current one. The results of this experiment showed that the Web version seems to be simpler and easier than the previous one.

Observing the user interaction during the experiment, it was noted, through direct observation, that while the users were trying to interact with the tool’s current version interface, they seemed “lost” and without action for few moments. Then, after some reasoning, they were able to use the interface using “cut-and-try”. In the Web version, the user interaction seemed to be easier, because the interface widgets were organized in a better way, making the interface more clear and intuitive to use. These characteristics were noticed using “thinking aloud” technique, i.e., listening what the users say during their interaction.

Some difficulties related to the new version were observed too. One of the problems was related to the educator literacy relative
to the IEEE LOM metadata fields. This problem was solved using tooltips to describe the purpose of each metadata field (Figure 9). The other difficulty was related to how to copy the chosen concepts to the corresponding metadata field. To solve this problem, it was proposed the insertion of copy to field button (Figure 10). Additionally, the experiment showed that the common sense knowledge is useful to support the contextualization of the LO’s metadata and to be used as a support for other tool’s features like the creation of the content’s structure according to the users’ verbal report and also as it was showed in a case study conducted in 2008 [4].

The next steps of this work include the creation for the Web version of the current version’s correspondent functionalities. This development will be followed by other experiments, aiming to validate all the implemented features. As future works it is proposed to make the editor a collaborative authoring tool, an important feature in the current knowledge society which prizes the work in group, and to perform new usability tests to keep the tool improving towards efficiency, efficacy and satisfaction.

8. ACKNOWLEDGMENTS

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9. REFERENCES


