FOSTERING DISCUSSIONS WITH FORUM TOOLS 
BASED ON E-LEARNING STANDARDS

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ABSTRACT
The research described in this article argues that linking deeply communication to learning activities offers an interesting approach to develop the efficiency of systems in facilitating and increasing discussions between learners. In this way, we propose a forum model that is based on two special features: contextual view and structuring. The contextual view of the forum, always visible, allows the user to focus on pertinent discussions. Two kinds of forum structures are offered: content structure and cognitive structure. In this paper, we focus on some technical considerations and more particularly we discuss the use of some e-learning standards (LOM, SCORM, …) as a basis for the design of the contextual forum tool.

KEYWORDS
Distance Education/Distance Learning, Computer Mediated Communication, Asynchronous Discussion, collaborative learning, Learner Communities and Peer-Support

1. INTRODUCTION
In distance learning, the emergence of learners’ communities has a favorable impact on learning conditions. In a socio-constructivist approach (Doise and Mugny 1984), interactions between learners play a dynamic role to individual learning. However, distance discussion tools are not always really suitable for the emergence of learners’ communities. Some works have highlighted that these phenomena are too rare in distance learning environments (Gommer and Visser 2001; Hotte and Pierre 2002).

Forum tools currently used in on-line educational platforms are mostly unspecific to educational situations (George and Hotte 2003). More particularly, current distance learning systems do not respect human communication process that is an “in context” process (Jakobson 1960). Our main idea is then to make communication more immediate during learning activities. The aim of our work is to design forum models and tools which are specific to distance learning systems.

This article depicts a proposal that aims to foster text-based asynchronous discussions (i.e. forum) during learning activities that are not collaborative a priori. During individual learning activities, providing only usual communication tools is not always sufficient to create interactions between learners and favor the construction of collective knowledge. Usual communication tools could be appropriate if a collective learning activity is set-up. Nevertheless, in distance education, all learning activities can not be collaborative and the approach presented in the chapter aims at encouraging interactions during individual activities that not commit learners to a forced collaboration.
2. CONTEXT AND RESEARCH ISSUES

Low interactions between learners into forum might come from discussion tools and more particularly from their lack of connection with learning activities and learning contents: "the problem with content-related communication often is, that it doesn’t occur because it is a separate activity that is not include in the course" (Gommer and Visser 2001). We postulate that the separation between learning activities and communication isn’t favorable to the emergence of discussions. We talk about learning activities in a broad sense: reading an electronic document, doing an exercise or using a simulation for example. Our research question lies in determining how to link discussion activities to learning activities by the mean of well suited computer tools.

We propose a forum model, named CONFOR (CONtextual FORum), which is based on two special features: contextual view and structuring. The contextual view of the forum, always visible, allows the learner to focus on pertinent discussions, i.e. on messages that correspond to his/her activity. Contextualization is common in annotation systems but not in forum tools. By adding this feature to forums, the intention is to closely link communications to learning activities. To provide this contextual view, the discussions need to be structured. We suggest in this research two means of structuring, according to (1) the content structure of a course and to (2) the cognitive structure of a course.

It is now assumed that many standards provide ways to describe a course structure (e.g. SCORM, IMS Content Packaging) and a cognitive structure (e.g. LOM) in learning activities. We will explain in the next part how CONFOR has been designed basing on these standards.

3. E-LEARNING STANDARDS AS A BASIS FOR THE DESIGN OF CONTEXTUAL FORUMS

3.1 Activity-based Contextual Forum

This first approach deals with the learner’s activity, i.e. the way a learner will follow the course. This mode aims at showing a partial view of the forum topics, directly linked to the current activity. This approach implies focusing on different points:

- the choice of the standard we should rely on to get the course structure and consequently impact the forum’s structure,
- the structure’s importation method, based on the chosen standard,
- the way the forum view should be refreshed, in order to keep the link between the learner’s activity and the related topics.

3.1.1 IMS Content Packaging and SCORM

There are actually three main e-learning standards that provide a way to describe a course content structure: AICC (Aviation Industry CBT Committee), SCORM (Sharable Content Object Reference Model) and IMS LD (IMS Learning Design). AICC and SCORM are currently used by a lot of structures either industrial or educational, whereas IMS LD increases constantly its community, proposing an alternative point of view. CONFOR has been designed in the beginning of IMS LD, that’s why it found its bases in SCORM, which was more developed at this time.

With SCORM, educational content may be sequenced for the learner: "One activity in the process of creating and delivering learning experiences involves the creation, discovery and gathering together, or aggregation, of simple assets into more complex learning resources and then organizing the resources into a predefined sequence of delivery" (Dodds and Thropp 2004a). The SCORM content aggregation model is a profile of the IMS content packaging specification, an IMS standard designed to describe a course in a package containing the course’s files and an XML document (imsmanifest.xml) describing the structure. In short, this document presents the following elements:

- Manifest: Root element of the document
  - Organizations: Contains different organizations for the course
    - Organization: Describe an organization for the course, structured in items
• Item: A course structure item
  • Resources: Contains the resources’ definition used within the course
    • Resource: A resource of the package, eventually referencing physical files. A resource may be an aggregation of HTML pages, animations, etc. …
  • File: Description of a physical file, associated to the resource

This architecture allows to describe precisely a course structure, and provides a way to retrieve this structure for other means, such as the forum tool.

Concerning IMS LD, this standard is based on the learner’s activity and describes pedagogical scenarios that s/he will follow during a session. Those scenarios introduce sequencing notions, pre-requisites, actors’ roles, to permit an elaborated pedagogical design. A deeper analysis could lead to a model allowing an IMS LD importation to get a forum structured as the pedagogical scenario.

It is to know that standards evolve constantly. For instance, they are presently discussed (IMS 2005) to be updated and standardized by IMS, ADL (SCORM authors) and IEEE LTSC. Thus, it could lead to an almost universal way to describe a content structure and, in this perspective, offers solid basis for designing this contextual forum.

3.1.2 Contextual Forum based on Educational Scenarios

We designed a contextual forum tool based on a strong parallel between learning activities (educational scenario) and discussion activities. In this first approach of forum structuring, each forum thread is linked to an item of the content navigation of an online course. In the model that we propose, each root message of the forum is a reference to a learning activity. Thus, a reference could be for example the title of a course chapter or the number of an exercise. The forum is then hierarchically structured according to learning activities, by reference to the course structure. According to contextualization seen above, the opening of an educational object leads to the opening of a forum partial view corresponding to the activity in progress. With these references, the goal is to focus learners’ exchanges on learning objects.

![Figure 1. Screen shot of CONFOR](image1.png)

The interface of the CONFOR tool is shown in figure 2. The upper part of the window contains a learning activity of an online course. Under this course is the contextual view of the forum, which is automatically updated depending on the upper part. For instance, in figure 2, a learner carries out the activity 2.2 of the module 2 of his/her course and s/he sees, at the same time, the messages of the forum that correspond to this activity (messages under the reference “activity 2.2”). This contextual view of the forum is a part of a unique global forum. It should be noted that this global forum can be displayed in a global view (to see the entire tree of messages). In both views – contextual or global – the left part of the forum displays the list of the
message titles and the references names. When user clicks on a message title, the content of the message is displayed on the right part of CONFOR. The forum can be resized or put in an “always on top” window.

In order to provide the contextual display of the forum, we have to define references in connection with the online course structure. In this model, references contained in the forum are linked to the learning activities structure. So references are dependent on the educational scenario designed by the author of the course. We suggest an automatic procedure to add references in the forum. We describe this procedure in the next part.

3.1.3 Module to import Course Structure

As we initially chose SCORM for data importation, the conception of the module to import course structures is essentially based on the analysis of imsmanifest.xml files. A class modelling can be obtained to virtually represent the course structure and then manipulate those objects in order to create a valid forum structure.

An inner objective of IMS Content Packaging is to provide a broad sphere of activity to a course designer, by allowing recursive inclusions of manifest elements. Each manifest element describing a structure, a designer may aggregate many structures in only one package, and have lots of possibilities. As we seen on part 3.1.1, in a manifest element, structures are described with the organization elements, containing item elements. Each item can be linked to either a resource or a (sub)manifest package (Dodds and Thropp 2004a). The possibility of recursive inclusions of manifests emphasizes the fact that a package can lead to many potential structures.

Therefore, we ended on the following steps for a content packaging import:
1. Package selection and definition of import options
2. First analysis to present the contained courses organizations
3. Presentation of the structure to import, regarding on the user’s selection
4. Creation of the forum structure(s)

3.1.4 Using Learner Navigation to display Contextual Discussions

SCORM describes also the way content objects should be launched by a LMS (Learning Management System). This part of the SCORM specification is known as the « SCORM Runtime Environment » (Dodds and Thropp 2004b). It essentially describes an interface between a SCORM compatible LMS and a content object. This interface consists of functions a content object can rely on to dialogue with the LMS. This API defines especially two functions (LMSInitialize() and LMSTerminate()), that a content object should call respectively at its beginning and its end. This particularity is linked to the goal of updating the forum contextual view, because of the necessity for a SCORM content object to call these functions. As the SCORM API has been designed to be written in an ECMAScript compatible language, our tool provides a function – we will further call setContext() – which updates the contextual view, regarding on a given URI. This URI should correspond to the entry point of the current content object, as defined in the associated resource element of the package description (imsmanifest.xml). Therefore, a way to use the forum tool and have the synchronisation working would be to modify the API and add a call to the setContext() method in LMSInitialize() that would update the forum view.

Another way, used for a wider compatibility with standards, is to regularly get the current content object URI from the content frame (using ECMAScript) and call the setContext() method. This method can only be reliable in a precise context, and can't be perceived as a reference.

We chose to only provide our own interface to update the forum view. In this way, we keep a component point of view, allowing the use of this tool in different contexts, as SCORM APIs are usually different for each LMS. As the setContext() method only depends on a IMS Content Packaging standardized parameter, interfacing the forum tool with a SCORM compatible LMS presents no major problem.

3.1.5 Results from an Experiment

An assessment has been carried out at the Tele-university of Quebec to evaluate the contextual forum. The experiment lasted 8 months and involved about 70 students. The goal of the assessment was to study the use of CONFOR. More specifically, we wanted to test the utility and usability of the forum contextual display. For the purposes of the assessment, we used questionnaires, interviews, and regular observations coupled with computer traces analysis. It should be pointed out that the course used to assess CONFOR was newly
offered by the Tele-university. For this reason, we will not directly compare the use of CONFOR with the one of other forums used at the Tele-university, too many parameters being different.

The questionnaire responses indicate that the students are quite appreciative of the reference-based structure of the forum. Similarly, even if a global view of forum was provided, they favor the forum’s contextual display (4.5 more messages opened in the contextual view than in the global view). Furthermore, the contextual view favors the sending of messages (7.5 more messages sent in the contextual view than in the global view). The results also indicate that CONFOR helps students in finding messages relevant to their activities, i.e. messages useful for the learning activity they are engaged in. Finally, students found that the forum fostered the organization of discussions.

At this point, we can thus conclude that contextualization of discussions for learning activities is appreciated. Users also seem to appreciate the fact that communication and learning are integrated into a single space. Having access to the opinions of others, as they carry out their learning activities, motivates students to locate discussions that help them to understand and to build their knowledge. From this point of view, we can contend that this kind of forum has a positive effect on learning. More detailed results of the experiment could be found in (George 2004).

3.2 Knowledge-based Contextual Forum

From the precedent work on activity-based contextual forum, an issue emerges: it would be a good idea to propose a different structuring of forum, by defining references in connection with knowledge dealt in online courses. From a first experiment of CONFOR, we observed that two messages could be situated in two different threads even though these messages dealt with the same content or with the same knowledge. So the goal became to design a structuring model based on knowledge representation while keeping the contextual view of forum. With this approach, the forum tool could provide some facilities for discussions convergent processes that are not supported in conventional threaded discourse environments (Hewitt 2001). We then use e-learning standards and taxonomies in order to retrieve knowledge elements tackled in online courses.

3.2.1 LOM and Dewey Decimal Classification

In on-line education, the metadata are used to describe the courses and the learning objects. They include a number of descriptors which are defined according to a standard, and which enable to make these courses and learning objects more easily accessible and more easily usable (interoperable, reusable, long-lasting, adaptable) (Downes 2001).

The standard LOM (Learning Object Metadata) is limited to a minimal set of essential characteristics to manage the learning objects, to seek them and evaluate them. A learning object is regarded here as “any entity, digital or non-digital, that may be used for learning, education or training” (Hodgins and Duval 2002). Nine categories are taken into account in order to describe the educational resources, but according to our objectives, they are not all of the same importance. The ninth category, named “classification”, is the category that particularly interests us in our context. This field ensures to classify and index educational objects according to a knowledge taxonomy. We studied various taxonomies which enable to describe the knowledge-elements approached in learning documents. We studied in particular the taxonomies used by the libraries: DDC (Dewey Decimal Classification), UDC (Universal Decimal Classification) and LCC (Library of Congress Classification). Among those we retain the DDC because it is flexible, simple to use and allows a classification of knowledge sufficiently fine for our work.

However, providing metadata is not always an easy work for some authors of learning objects. From their point of view, this work requiring a literature study, which is not always in their field of competences, is tiresome and non-productive. We believe that it will be one of the major problems for the development of educational objects. However, we take as a working hypothesis that, to use CONFOR, each learning object will be well documented and described with LOM. If this work is not done by authors, information specialists could do it.

3.2.2 Contextual Forum Based on Knowledge

We suggest a model of knowledge-based forum, in which the topics are organized according to a structure defined by the knowledge tackled in a course (see an example on figure 2). With the attribute “classification” of the LOM description of each educational object, the knowledge elements being consulted at a time can be
identified. Therefore, a forum function can show in a contextual way all the topics corresponding to these knowledge elements. The learner may then consult, share and interact with other learners about the course’s knowledge.

![Knowledge structure](image)

**Figure 2. An example of a forum that is structure according to knowledge elements**

### 3.2.3 Module to import Knowledge Structure

The use of IMS Content Packaging within SCORM lets a course designer the possibility to describe each resource used in the course, by using the metadata element. This element permits any kind of metadata description, so LOM can be used in particular to classify each resource, by using its ninth element named classification. In short, this element is composed of the following nodes:

- **Classification**: Root of the classification definition
  - **Taxonpath**: Root element containing taxon elements definitions
  - **Source**: Textual name of the source taxonomy
  - **Taxon**: The taxon definition
    - **id**: identifier relative to the given taxonomy
    - **entry**: the taxon’s label
  - **Keyword**: A keyword semantically linked to the resource’s classification

We can see that each taxon element gives information about the knowledge fragment approached within the resource. Besides, the Dewey Decimal Classification identifiers’ composition permits to deduce a tree view of the knowledge classification. This gives all needed information to handle a knowledge structure from the resources’ metadata definition: each taxon identifier can be analysed to rebuild the entire knowledge structure for a given course. This structure is kept within a particular forum, and will therefore reference any discussion about a given “knowledge element”.

As a remark, this mode encourages fulfilling every resource’s metadata by taking advantage of the classification definition, and getting the cross navigation, as interactions, richer.

### 3.2.4 Mechanism to detect Knowledge Elements consulted

As depicted in previous part, with the attribute “classification” of LOM, we can identify the knowledge elements (KE) being consulted. Therefore, a function of the forum can show in a contextual way the topics corresponding to these KEs. In this way, a learner wanting to discuss about the knowledge-element number 1.1 (KE1.1) approached in a learning object 1 (LO1) will be able to see all the messages under the topic KE1.1 and will be able to post its message under this topic. Moreover, several KE could be shown at a time if the LOM description contains more than one DDC index. The learner may then consult, share and interact with other learners about the knowledge treated in the course.

Figure 3 shows how a learner uses an on-line learning environment to consult his/her courses and to communicate with the forum. At a given time, he can open a particular learning object (1). A function of the system recovers automatically the DDC indexes of the KEs treated in this LO (2) using the LOM description of the LO. Then, the forum seeks the DDC indexes of each KE in the structure of the forum (3). The forum then opens in a contextual way (4) by showing the messages in relationship with the KEs treated in the LO.
An advantage of this mechanism is that two students who work on two different LOs will be able to meet on the same forum to discuss a common KE.

4. TOWARDS AN INTEGRATED APPROACH OF CONTEXTUAL FORUM

Our current research concerns the integration of the two models presented above. Actually, using a singular approach has some limitations. In the first approach, contextual forum based on educational scenarios, some messages could be situated in different threads even though these messages dealt with the same content. In the second approach, knowledge-based contextual forum, general discussions about learning activities have no place in the knowledge structure.

The idea of integration consists in showing the learners a discussion thread corresponding to the current activity (to discuss about the organization inside the course for example) and also the discussion threads corresponding to knowledge at stake at a time (in order to discuss about the content). The figure 2 represents a model which takes into account these two levels of contextual discussions.
In this model, an educational object – or a resource – is referenced as an object of an educational scenario (in the upper part of figure 4) and this object also deals with several knowledge elements described in its metadata (in the lower part of figure 4). Knowledge elements could be defined by an ontology of a particular field or by a taxonomy like Dewey (DDC). Always in this model, each circle is then a discussion topic inside the forum. So, when a learner opens an educational object, the contextual forum displays automatically the activity topic and all the knowledge topics linked to the resource.

Finally, the figure 5 shows the interface of the integrated contextual forum. Two thumbs enable to see either the activity-based contextual forum or the knowledge-based contextual forum.

5. CONCLUSION

Our research aims at proposing specific forum models and tools for on-line education in order to foster discussions between learners. The work led to the idea of contextual display of forum messages. We suggest two versions of contextualization. The first one is based on a forum structuring according to on-line course structures. Some results of an experiment led us to study another forum structuring, by taking into account the cognitive structure of a course. The result is a discussion tool, named CONFOR, which displays to the learner an “activity topic” and several “knowledge topics” linked to the learning resource that is open. The last version of CONFOR will soon be tested in order to validate the underlying model. Moreover, a long-term experiment with several groups of students will be conducted to measure the impact of CONFOR on the quality of learning.

The CONFOR model and tools are based on current emerging e-learning standards. In particular, CONFOR uses, in one hand, SCORM for the learning activity structure and, on the other hand, LOM combined with Dewey Decimal Classification for the knowledge structure. Nevertheless, CONFOR could easily evolve to take other standards, like IMS-LD or future standards (IMS 2005), into consideration.
REFERENCES


