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## **BRIDGING THE GAP BETWEEN HUMAN COMMUNICATIONS AND DISTANCE LEARNING ACTIVITIES**

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### **Abstract:**

*This chapter introduces context aware computer-mediated communication for distance learning systems. It 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. To make this link, the author bases his work on various theories, such as communication theories, situated cognition theory and activity theory. This theoretical study leads to research issues concerning a contextual forum model. The description of the computing implementation of this model aims at giving researchers some possible uses and recommendations in dealing with context-sensitive communication tools. Finally, the chapter mentions futures trends and suggests emerging research opportunities within the field of communication services which are able to adapt dynamically to the user's activity.*

**Keywords:** Distance Education/Distance Learning, Computer Mediated Communication, Asynchronous Discussion, Human/computer interaction, Socio-Technical Systems, Technology-Enhanced Learning

## INTRODUCTION

In a distance learning context, the emergence of learners' communities has a favourable impact on learning conditions. Indeed, in a socio-constructivist approach (Doise & 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 & Visser, 2001 ; Hotte & Pierre, 2002).

Forum tools currently used in on-line educational platforms are mostly unspecific to educational situations (George & Hotte, 2003). The discussion activities are not linked to the learning activities, consequently this does not encourage the learners to use them for communication. Current distance learning systems don't 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 this chapter is to describe the conception of forum models and tools which are specific to distance learning systems. The research question lies in determining how to link discussion activities to learning activities by the mean of well suited computer tools. On the whole, the work concerns the design of human communication systems that attempt to respect human thought process. We totally agree with the paradigm "Cognitively Informed Systems", which defines systems that utilize, as a basis for their design, some form of cognitive findings to enhance the effectiveness of the systems in achieving their targets. For the design of our communication system, some results from communication theories, situated cognition theory and activity theory are used to develop the efficiency of the system in facilitating and increasing discussions between learners. These theoretical considerations guide the system design towards a more effective presentation of discussions.

The chapter concerns the design of forum models and tools which aim at promoting text-based asynchronous discussions during learning activities that are not collaborative *a priori*. During individual learning activities, to only provide usual communication tools is not always sufficient to create interactions between learners and favour the construction of collective knowledge. Usual communication tools could be appropriate if a collective learning activity is set-up, during a project-based learning for example (George & Leroux, 2001). 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.

We propose a forum model, named CONFOR (CONtextual FORum), that 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. 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.

This chapter starts by a discussion about some theories we rely on. This first part leads to the research issues. Then, two ways to structure contextual forums are detailed before proposing an approach to integrate them. Finally, we give some results of an experiment and we mention lines of future trends.

## **THEORIES BACKGROUND AND RESEARCH ISSUES**

This section presents a literature review to support our position. We conclude this section by stating our research issues.

### **Theories of Communication**

Numerous theories of communication have been developed. The aim of this part is not to make a complete state of the art of these theories but to underline some aspects especially interesting for the research.

According to the model of Jakobson (1960), all acts of communication, be they written or oral, are contingent on six constituent elements: Addresser, Message, Context, Contact, Code, Addressee. The “context” element interests us particularly because it defines the frame of the message reference, i.e. the ground on which a communication can occur. This referential function emphasizes that communication is always dealing with something contextual. Indeed, *“When humans talk with humans, they are able to use implicit situational information, or context, to increase the conversational bandwidth. Unfortunately, this ability to convey ideas does not transfer well to humans interacting with computers.”* (Abowd & Dey, 1999, p.1). This notion of context is rarely explicit during mediated communications, except by the addresser of the message. One of our goals is to contextualize communication in e-learning situations, that is to link discussions to context of discussions.

### **Situated Action Theory**

Works on communication theories can be complete with some other works dealing with situated actions (Lave, 1988 ; Suchman, 1987). The term “situated action” underlies the idea that each action closely depends on material and social circumstances in which it occurs. Situated

action theory introduces an interesting idea: action is not the execution of a ready-conceived plan, but it is the user's adaptation to the context. Applying situated action theory to computer mediated communication, Mantovani (1996) concludes that users are social actors with their own aims and autonomy in situations, and it is technology which must adapt to them. In this sense, *“the most effective way of clarifying the meaning of messages is to relate them to a shared context”* (Riva, 2001, p.217).

Thus, by extension, communication is a situated activity (Lambert, 1992). The situated actions theory pointed out the fact that communications should occur during the action, at the time when the user needs it. So if a user can't communicate easily in action, s/he will not do it. Our work aims at facilitating communication in action.

### **Activity Theory**

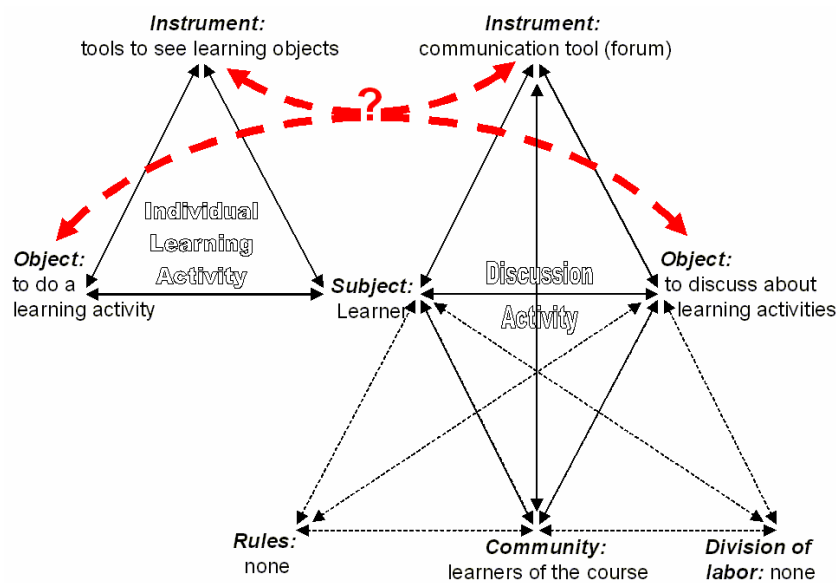
Another theory can throw light on the issues: the activity theory (Leontiev, 1978). This theory, based on the initial ideas of Vygotsky, emphasises how knowledge is “socially constructed”. In this way, activities are integrated in a social matrix composed by persons. Basing on this theory, Engeström (1987) has suggested a framework for a collective activity. His popular representation of activity theory adds to the triangle subject-object-artifact (Vygotsky, 1978) another level containing rules, community and division of labor. Thus, the first relational triangle – the subject who achieves an object by using instruments (computer tools for example) – is then widened to show that a subject is not lonely but is a part of a community.

The activity theory is not only useful to describe the humans' behaviour during collective activities but also makes it possible to conceptualize collective learning. Thus, these principles can offer a framework to analyze and conceive educational environments (Lewis, 1997 ;

Roschelle, 1998). The next section will come back to the utility of this approach to better understand communication activities during individual learning activities.

## Research Issues

We can use the representation of human activity of Engeström (1987) to illustrate the two activities that interest us in this research: individual learning activity and discussion activity (figure 1).



**Figure 1. Linking learning activity and discussion activity through activity theory**

We remind the reader that we focus our work on learning activities that are *a priori* defined to be individual but with possible and desirable communications between learners. Figure 1 shows that, currently in this situation, learning activities and discussion activities are not linked. On the one hand, the learner uses different tools to see learning objects in order to do a particular learning activity (small triangle on the left part of figure 1). On the other hand, the learner can use communication tools (as forum) to discuss with other learners of the course (big triangle on the right part of figure 1). In our case, the community do not have imposed communication rules or

recommendation to divide the labour. Within this configuration, the only link between learning and discussion activities is the learner. To see the emergence of a community, it supposes that learners have the capacity to link themselves the two activities. We have symbolized by a question mark the point that seems important to us and that is currently missing. It could be seen as a synchronisation point between learning and discussion activities. In other words, we aim at studying communication artefacts as integrated and inseparable components in human learning activity. How to merge the two triangles together?

Starting from these considerations, the work consists in finding a solution to deeply integrate communication into distance learners' activities. Learning activities are taken in a broad sense such as reading an electronic document, doing an exercise or using a simulation. On the one hand, we want to make communication more **situated** in distance learning system and, on the other hand, we aim at defining more explicitly the **context** of each discussion.

We focus on one kind of communication tools in distance learning systems: forums, which are tools for asynchronous communications. The research question lies in determining a model of contextual forum and to develop computer tools based on this model. Currently, we have studied two means to contextualize discussions, which are described in the following part.

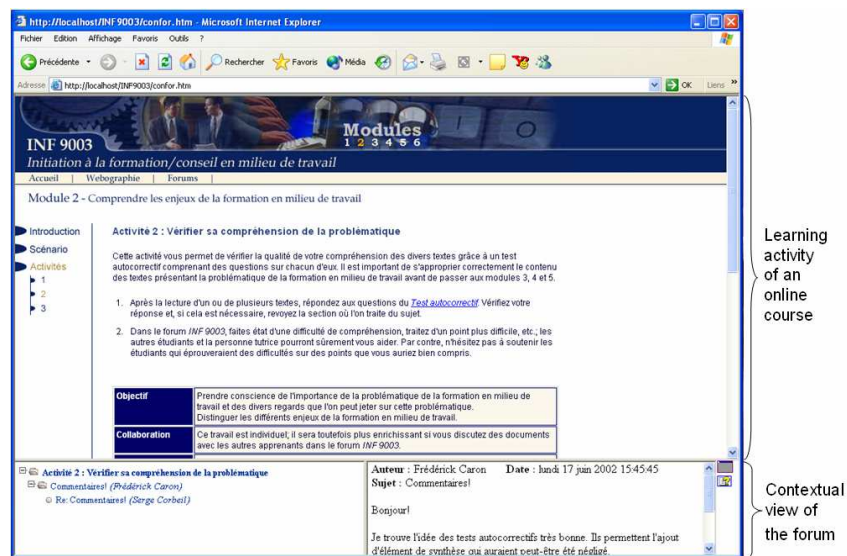
## **WORK ON CONTEXTUAL FORUM**

In this section, we discuss two kinds of contextual forums structuring studied in our work. The first one is based on educational scenarios and the second one is a knowledge-based forum structure. We propose then a solution to integrate these two approaches. Finally, we mention current results of our research on contextual forums.



## Contextual Forum Based on Educational Scenarios

In the first approach of forum structuring, each forum thread is linked to an item of the content navigation of an online course. For that, educational content may be sequenced for the learner: *“the branching and flow of that content may be described by a predefined set of activities, typically defined at design time”* (Dodds, 2003, p.13). In the model that we propose (George & Hotte, 2003), 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.



The screenshot shows a web browser window with the URL `http://localhost/INF9003/confor.htm`. The page title is "INF 9003 Initiation à la formation/conseil en milieu de travail". The main content area displays "Module 2 - Comprendre les enjeux de la formation en milieu de travail" and "Activité 2 : Vérifier sa compréhension de la problématique". Below this, there is a table with "Objectif" and "Collaboration" sections. At the bottom, a forum thread is visible with the subject "Activité 2 : Vérifier sa compréhension de la problématique" and a message from Frédéric Caron.

Learning activity of an online course

Contextual view of the forum

Figure 2. Screen shot of CONFOR

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. This 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. The question is then to determine how to add these references before the course starts. A solution is to give the possibility of manually inserting references. For that, we propose a designer interface in CONFOR allowing this manual definition of references. Each reference is defined by a name and a link. The name will appear in the forum and the link is the reference to the educational object or to the learning activity (an URL for example). Moreover, references are linked together in a hierarchical manner. Nevertheless, this manual definition of references can become a hard work if the course is large. For this reason, we also suggest an automatic procedure to add references in the forum. For instance, an automatic import procedure has been done for educational scenarios described with SCORM (Sharable Content Object Reference Model).

## **Knowledge-Based Contextual Forum**

From the precedent work, 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 (cf. the last part of this section), 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.

We studied various taxonomies which make it possible to describe knowledge elements approached in learning documents. In particular, taxonomies used by libraries have been examined. Among those, we chose the Dewey Decimal Classification (DDC) because it is flexible, simple to use and allows a classification of knowledge sufficiently fine for our work. The DDC is a knowledge organization method which is used worldwide. It is universal because it uses numerical indexes to classify documents and, thanks to its international standardized notation, it is alphabet and language independent.

We choose to use the DDC in conjunction with the Learning Object Metadata (IEEE, 2002). In online education, the metadata are used to describe courses and learning objects. They include a number of descriptors which are defined according to a standard, so these courses and learning objects are more easily accessible and usable: interoperable, reusable, long-lasting, adaptable (Downes, 2001). LOM contains nine categories in order to describe educational resources but, according to our objectives, the ninth category, named “classification”, is the category that specially interests us for contextual forum. This field ensures to classify and index educational objects according to knowledge taxonomies, as the DDC.

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.

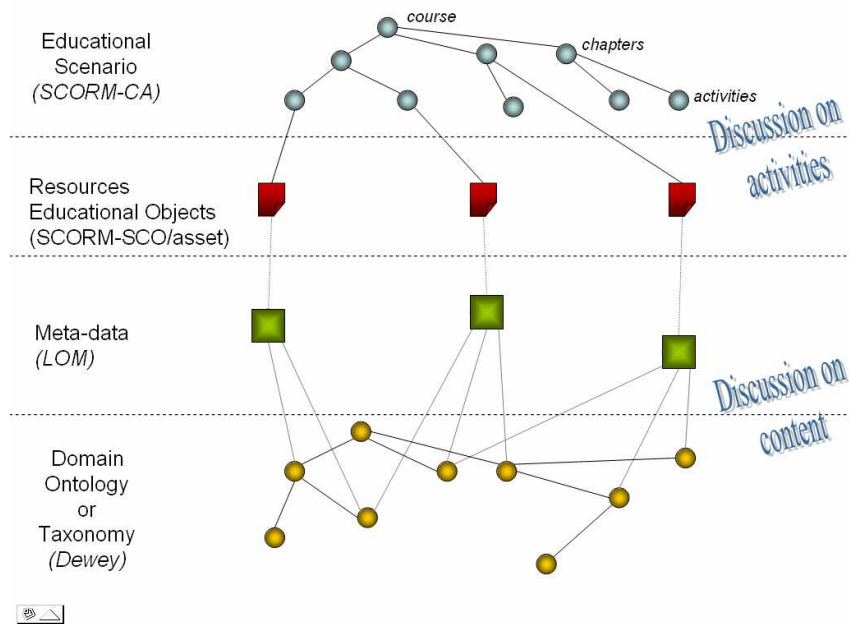
Then, we suggest a model of knowledge-based forum. In this model, the topics are organized according to a structure defined by the knowledge tackled in a course. With the attribute “classification” of the LOM description of each educational object, the knowledge elements being consulted at a time can be identified. Therefore, a forum function can show in a contextual way all the topics corresponding to these knowledge elements (George, 2004). The learner may then consult, share and interact with other learners about the knowledge of the course. An advantage of this mechanism is that two students who work on two different learning objects will be able to meet on the same thread to discuss a common knowledge item.

### **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.



**Figure 3. An integrated model of contextual forum**

In this model, an educational object – or a resource – is referenced as an object of an educational scenario (in the upper part of figure 3) and this object also deals with several knowledge elements described in its metadata (in the lower part of figure 3). 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.

### **Current Results**

An assessment has been carried out at the Tele-university of Quebec to evaluate the contextual forum. CONFOR was assessed within an introductory course on “training in the workplace” offered to students registered in an undergraduate certificate program in business-oriented

computer sciences. The CONFOR version used for this experiment was the first version, with the forum structure only based on educational scenarios. Nevertheless, this experiment gives interesting information.

The experiment lasted 8 months and about 70 students have taken the course. During the evaluation, two different tutors supervised the 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 that 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 favour the forum's contextual display (4.5 more messages opened in the contextual view than in the global view). Furthermore, the contextual view favours 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. Since forums are also an important tool for e-learning tutors, we conducted semi-structured interviews with them to obtain information on their use of CONFOR. Tutors found the interface simple and intuitive to use. Concerning utility, tutors appreciated having the forum and the course on the same page. They appreciated the ease of locating new messages, which facilitated their monitoring activities.

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.

## **CONCLUSION AND FUTURE TRENDS**

There is an increasing need for context aware services and applications which are able to adapt dynamically to the user's activity. Dey (2000) states that "*A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task*" (p. 6). In other words, context sensitive applications are those that respond to changes in their environment. Some researches have been done in this direction, for example in the field of mobile and ubiquitous computing. The general aim is to make information more relevant to the situation in which it is being used. Mechanisms to provide context-sensitive help are common examples.

We introduce in this chapter a new idea that consists in defining a context-driven support communication. Our research aims at proposing specific forum models and tools for on-line education. 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 which displays to the learner an "activity topic" and several "knowledge topics" linked to the learning resource that is open. Currently, the context is limited to the activity in progress and to concepts

studied at a time. We wish to extend the notion of context, taking into account more parameters such as learner's history or learner's goals. Then, we could use this information to better adapt displayed topics to each user. For example, carrying out the same activity, two learners would see different and specific discussions topics according to their past actions and to their personal characteristics.

We can also mention some limits of contextual communication tools. As pointed by Dimitracopoulou and Petrou (2004) and take up by Gao *et al.* (2005) "*the problem with the systems that contain embedded communication tools is that discussions are usually fragmented by artefacts, which causes learners to lose a holistic view of the discussion and the relationships between different aspects of the artefact*" (p. 76). In our case, we try to reduce this effect by providing also a global view of forum discussions. We believe that developing contextual communication tools, it should be suitable to give several ways to enter and to read the discussions.

Furthermore, we only study at this time a context sensitive asynchronous system but we want to extend the mechanism to synchronous discussions ("contextual chat"). A future trend will be to no longer seen forum or chat tools simply as a communication tools, but also as tools helping to put users in touch with others. These kinds of context-aware communication tools will bring users together depending on their interests, motives or needs.

Finally, we don't believe in completely generic context-sensitive applications. Context gathering mechanisms could not be totally generic. In the case presented in this chapter, the context gathering mechanism is adapted to the e-learning situation even if the global model is generic. We could easily adapt it to a computer-supported cooperative work system for example but the sensors would not be the same. Context driven support communication will be really pertinent only if situations are well defined and if users' activities are circumscribed.



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