A Forum-based Organizational Memory as Organizational Learning Support

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ABSTRACT: Information and Communication Technologies have transformed the way people work and have a growing impact on long life learning. Organizational Learning is an increasingly important area of research that concerns the way organizations learn and thus augment their competitive advantage, innovativeness, and effectiveness. Within the project MEMORAe2.0, we are interested by the capitalization of knowledge in the context of an organization and by organizational learning. We developed the E-MEMORAe2.0 environment which is based on the concept of learning organizational memory. In this paper, we present the organizational learning approach; we stress the role of an organizational memory in this approach; we define the concept of learning organizational memory; and we specify the use of a forum concept in such a context. Then we present the approach MEMORAe, the environment E-MEMORAe2.0 we developed and its evaluation.

Categories and Subject Descriptors
I.2.6 [Learning]; Knowledge acquisition H.4.3 [Communications applications]:

General Terms
Organizational learning, Organizational memory

Keywords: Learning organizational memory, Organizational learning, Forum, Community of practice, Ontology

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1. Introduction

Globalization, information and communication technologies (ICT), innovation, are the new criteria of the economic environment. They transformed our way of learning and working. The company’s knowledge capital is increasingly crucial. The existence of an organization depends mainly on its capacity:

- To access new knowledge (technological survey, innovation, experience feedbacks...),
- To diffuse its know-how quickly (integration of new collaborators, harmonization of practices in company...),
- To exploit efficaciously and preserve its fields of expertise durably (sharing good practices, knowledge management, capitalization...).

In this context, companies must take into consideration two new risks:

- Knowledge obsolescence with respect to its environment (technologies, competitors, markets, methods...). It is thus necessary to change from a stock logic to a flow logic which could be used to set up devices of training and innovation.
- Loss of know-how, competencies. This loss can take place in time (retirement, mutation...). It can also take place through space when know-how, competencies are used only in one site but not in the other sites of the company.

The traditional organizations don’t favour learning and thus are not prepared to answer to these risks. A great number of lessons, experience feedbacks are acquired then lost. In order to cure that, traditional organizations must transfer towards learning organizations, i.e. organizations in which work is embedded in the organizational culture that allows and encourages the training at various levels (individual, group and organization) and the transfers of knowledge between these levels. Two ways seem promising for allowing this change: facilitating the constitution of communities of practice (CoPs) and facilitating the organizational learning. A digital environment based on an organizational memory could serve these two ways.

Within the project MEMORAe2.0 [1], our objective is to valuated the contribution of organizational memory and community of practice for favouring organizational learning. In order to support organizational learning we developed the E-MEMORAe2.0' environment based on an organizational memory allowing the capitalization and the distribution of knowledge and resources. Thanks to this environment, users can use, produce or exchange resources and knowledge. They have to access to communication resources (like course, book, … ) but also to exchange resources (like forum) and they can adapt them to their needs thanks to different types of memory.

In the following, we present the organizational learning approach, we stress the role of an organizational memory in this approach and we define the concept of learning organizational memory. We show how it enables knowledge transfer processes thanks to the use of community of practice and tools like forum. Then we present the approach MEMORAe and we describe how we implemented this approach in the E-MEMORAe2.0 environment. Finally we present the E-MEMORAe2.0 evaluation and feedback.

2. Organizational learning, organizational memory and learning organizational memory

A learning organization (LO) is an organization in which processes are imbedded in the organizational culture that allows and encourages learning at the individual, group and organizational level [Senge 1990]. Thus a LO must be skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights [Garvin 1994]. According to [Dodgson 1993], a LO is a firm that purposefully constructs structures and strategies so as to enhance and maximize organizational learning (OL). An
organization cannot learn without continuous learning by its members [Dodgson 1993]. Individual learning is not organizational learning until it is converted into OL. The conversion process can take place through individual and organizational memory [Nevis 1995]. The results of individual learning are captured in individuals’ memory. And, individual learning becomes organizational learning only when individual memory becomes part of organizational memory [Cohen 1991]. Finally, OL seldom occurs without access to organizational knowledge. In contrast to individual knowledge, organizational knowledge must be communicable, consensual, and integrated [Ducan 1979].

Indissociable of the memory [Lehner 1998], the learning is the process which implies the discovery, the memorizing and the exploitation of stored knowledge [Moorman 2008]. Continuing work of Walsh and Ungson [Walsh 1991], Stein and Zwass [Stein 1995] define the organizational memory as the means by which the knowledge of the past is applied to support the present activities.

According to Stein [Stein 1989], an organizational memory is defined as “the means by which knowledge from the past is brought to bear on present activities and may result in higher or lower levels of organizational effectiveness”. It can be regarded as the explicit and persistent representation of knowledge and information in an organization, in order to facilitate their access and their re-use by the adequate members of the organization for their tasks [Dieng 1998].

An integrated organizational memory provides a mechanism for compatible knowledge representation, as well as a common interface for sharing knowledge, resources and competencies [Brown 1991]. For Girod [Girod 1995], there are three levels of organizational memory:

- An individual level of the organizational memory: the individual memory indicates the knowledge held in the brain of the individual and knowledge visible in the form of documents held physically by individual (files in its office, documents various, etc).

- A collective level not centralized of the organisational memory: these collective memories are the consequence of the interactions between individual memories and exchanges emergences, communication between two or several people, being able to lead to a common interpretation allowing the decision-making.

- A centralized level: since the collective memory attains all the actors of the organization, it becomes coordinated and centralized, which is the case at the time of the existence of a bank of data or a consultable document by all.

Finally an organizational memory seems indispensable for organizational learning. In a learning context, we propose the concept of learning organizational memory which resumes the definition of an organizational memory [Dieng 1998] specifying that tasks are learning tasks. Following Girod work, we distinguish three levels of learning organizational memory: individual, organizational not centralized and centralized.

3. Community of practice and forum

Learning organizational memory can include at the same time physical data like reports, articles but also information expressed traditionally without physical support such as tacit knowledge, experiments, critical incidents or details on the strategic decision-making. Ideas produced by the employees during their tasks seldom exceed the circle of a small group or a team. This abstract or practical knowledge is the key of the organizational learning [Brown 1991].

A growing number of people and organizations in various sectors are now focusing on communities of practice (CoPs) as a key to improve their performance. CoPs are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly [Wenger 1998]. According to Wenger, CoPs are everywhere - at school, at work, in our hobbies... Members of such a community are informally bound by what they do together and by what they have learned each other through their exchanges about what they do [Wenger 1998]. He defines a community of practice along three dimensions:

- What it is about: the subject of interest.
- How it functions: members are engaged together into a social entity.
- What capability it has produced: a set of shared resources (vocabulary, documents, sensibilities...).

When the interest of the community is learning, what is case of a learning organization; we call it community of learners. These communities must be able to exist within training. Their aim is to facilitate sharing, exchange or the capitalization of knowledge to allow learning. They can be supported by tools based on Web2.0 technologies. Indeed, these last ones enable to develop tools like forum in order to facilitate knowledge sharing, exchange and capitalization. Like Wiki, a forum enables visitors to exchange information. The difference is that a forum is divided into several topics. Each topic starts with a question asked by a visitor and is followed by visitors answer. Thus each visitor can read a question and the answers posted, take a new question or reply to a question. As pointed out by [Mossand 2004], forums used in on-line educational platforms are not specific to the educational context. The communication activities are detached from the learning activities [Looi 2001]. However, in a learning context, its use is too general to be efficaciously exploited. In a learning context, we proposed to design a forum structured according to the knowledge to learn, allowing the students to communicate in a more contextual way: the learning activity which is carried out. The purpose of this forum is to give the possibility of consulting messages, notes concerning the learning activity of the students, i.e. in relation to the knowledge being treated at a given time. Forum is an interesting tool enables learners to exchange information inside a community. This exchange facilitates externalization of tacit knowledge.

4. The approach MEMORAe

Forum seems to be a good way to favour communication and exchange in a community and CoPs seem to be a key asset for facilitating organizational learning and innovation. One of the principal reasons for which CoPs are regarded as an important vehicle for the innovation is their potential to create an environment where members feel well for sharing ideas. However, it is not because they are formed naturally that the organizations should make nothing to influence their development [Wenger 1998]. Put spaces of resources exchanges and ideas sharing at the disposal of the organization actors around a common vocabulary is a means to support communities of practice.

Our aim, with the MEMORAe approach, is to operationalize connections between e-learning and knowledge management. To that end, our objective is to model and build a learning environment taking into account at the same time these two aspects. Within the framework of the MEMORAe approach, we propose to associate knowledge engineering and educational engineering in order to model and build a learning environment according to the approach.
by the resources. So, we made the choice to test and evaluate the contribution of the organizational memories based on ontologies in a context of training within a learning organization. This approach involves two projects: MEMORAe and MEMORAe2.0.

Within the project MEMORAe [Abel 2004], first we were interested in the knowledge capitalization in the context of organizations and more precisely the capitalization of the resources related to this knowledge by means of an learning organizational memory. We particularly focused on the way organization actors could use this capitalization to get new knowledge. To that end, we developed the environment E-MEMORAe as support for organizational learning. In such a system resources are indexed to knowledge organized by means of ontologies: domain and application. The domain ontology defines concepts shared by any organization; the application ontology defines concepts dedicated to a specific organization. Using these ontologies, actors can acquire knowledge by doing different tasks (solving problems or exercises, reading examples, definitions, reports...). We used Topic Maps [XTM] as a representation formalism facilitating navigation and access to the resources. The ontology structure is also used to navigate among the concepts as in a roadmap. The user has to access to the resources which are appropriate for him.

Secondly, we are interested in using the MEMORAe approach in an organizational learning context. To that end, we take into account different levels of memory and different ways to facilitate exchanges between the organizational actors. The environment E-MEMORAe2.0 has been designed and is meant to be used by a SLO2 and to facilitate CoPs development. In such an environment, there is a difference between knowledge and resources of: a) the whole organization; b) a community of practice in the organization —

2 In the Information Systems context, the “Semantic Learning Organization” (SLO) is an emerging concept that extends the notion of learning organization in a semantic dimension. A SLO must be considered as a learning organization in which learning activities are mediated and enhanced through a shared knowledge representation of the domain and context of the organization [Sicilia 2005].

To that end, we designed the learning organizational memory around two types of sub-memory that constitute the final memory of the organization:

• Group memory: this kind of memory enables all the group members to access knowledge and resources shared by them. The group is at least made of two members. We distinguish three types of group memory corresponding to different communities of practice:
  - Team memory: The team memory capitalizes knowledge, resources, communication concerning any object of interest of the group members.
  - Project memory: The project memory capitalizes knowledge, resources, communication concerning a project. All the information stored is shared by the members who work on the project.
  - Organization memory: this memory enables all the members of the organization to access knowledge and resources without access right. These resources and knowledge are shared by all the organization members.

• Individual memory: this kind of memory is private. Each member of the organization has his own memory in which he can organize, and capitalize his knowledge, resources.

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Figure 1. Part of the domain ontology
These memories offer a way to facilitate and to capitalize exchanges between organization members. For this purpose, we extended MEMORAE ontologies to represent these sub-memories and exchange resources, Fig 1.

In order to assess our approach, we chose to build learning organizational memory for academics organization: a course on algorithms and programming at the Compiègne University of Technology (France) and a course on applied mathematics at the University of Picardy Jules Verne (France). This choice of applications is justified by two observations:

A course is made of actors (learners, instructors, trainers, course designers, administrators, etc.), resources of different types (definitions, exercises, etc.), written in various forms (books, reports, etc.) and on various supports (paper, video, audio, etc.) thus knowledge and competences which it must bring. In this sense, a course is an organization.

Learner which participate in a course must get ready to their professional life and thus with an organizational learning.

5. E-MemoraE2.0 environment

The purpose of the E-MEMORAE2.0 environment is to facilitate the organizational learning. It is an extension of the E-MEMORAE environment. This environment helps memory users to learn courses notions by facilitating exchanges, knowledge transfer within a community of learners (exchanges are implemented by means of Web2.0 technologies).

5.1. Knowledge access

The environment enables to navigate in the application ontology dedicated to the selected formation and to find resources indexed by concepts. The general principle is to propose to the learner, at each step, either precise information on what he is searching for, or graphically displayed links that allow him to continue its navigation through the memory.

To be more precise, the user interface (Fig. 2) proposes:

- An access to different memories (in top on the left), specifying the memory visualized and allowing to access to authorized memories. By default, the user visualizes his private memory.
- Entry points (left of the screen) enabling to start the navigation with a given concept.
- A short definition of the current notion.
- A part of the ontology describing the current resource is displayed at the center of the screen.
• A list of resources (bottom of the screen) which contents are related to the current concept.
• History of navigation.

5.2. Knowledge exchange
When a user opens a connection he directly accesses to his individual memory. He can then navigate through the application ontology and access to resources which he himself added. A click on one of the bonds into high left enables him to change of memory; a memory of a group to which he belongs.

This change of memory makes possible:
• Visualization of others resources capitalized by the group members (figure 4).
• Addition of entry points (figure 3) making it possible for example to draw other members of group attention to a particular concept.

Thus figure 4 shows that user can add resources in individual memory. He indexed two types of resources which are visible only in its individual memory (delivers and comment) whereas the organization as for it gives access to other resources such as courses or exercises.

5.3. CoPs into practice
5.3.1. Working Group. In order to encouraging CoPs, we defined and associated to each group a common work. This one is a mathematical problem that group must solve. In each group memory, an entry point was added in order to access to ontology concept representing the problem that group must resolved (the last entry point of the right of Fig 5).

Each problem has a type which is linked to application ontology concept by the relation: “met-en oeuvre” (to use). This relation enable to reach knowledge concerning by the problem solving. As illustration, the figure 6 introduces three problems of type “Problem: Loi/Estimation/Tests d'hypothèse” (Prob: Law / Estimate / Tests of hypothesis). Problem Prob2 is in the centre of the ontological view and we can access to indexed resources among these we find the problem statement.

The figure 7 shows knowledge useful to solve a problem of type: “Prob: Loi/Estimation/Tests d'hypothèse” (Prob: Law / estimate / test of hypothesis).

With this relation student can begin his navigation in the ontology. These knowledge are necessary to the problem solving so student must acquire them in order to solve his problem.

Ontologies enable to organize and capitalize the exchanges. Indeed, in order to facilitate the externalization of tacit knowledge, we chose to associate exchange resources to each concept of the application ontology. Exchange resources concern a concept and can be asynchronous (forum, blog, e-mail) or synchronous (chat). They give the opportunity to group members to exchange and share information on a subject, this concept indexes the exchange resource. Currently these informal exchanges are carried out only in written form, we envisage to offer an oral form via the use of technologies Internet (for example skype).
5.3.2. Forum. Our aim is to reify discussions, informal exchanges with learning activities. To do that, we propose to define the forum topics according to the concepts to learn. We associated to each memory formation a forum whose fields correspond to the concepts of the application ontology. In this way, exchanges are capitalized and accessible to formation actors according to their rights.

Thus, we built a forum from the application ontology. Each concept of this ontology gives access to a forum fields. Each forum fields are composed by several question/answer which corresponds to one resource. Answers are capitalized and visualized in the resource content. Figure 8 shows in French the two questions concerning the concept ‘Ensemble(population)’.

Each resource of forum type is formed by the subject of the question (its title), the question itself and information relative to its emission (author, date, time) and the different answers brought by users (figure 9).

Forum enables exchange information between different users. Users can ask a question in order to get new knowledge. Users can also answer question and by this way externalize tacit knowledge. Tacit knowledge are difficulty expressible because they are rooted in the actions (for example: the turns of hand, the intuitions, presentiments). These are individual knowledge frequently transmitted in the mode “Master-Apprentice”, rather by the practice or discussion than procedure or instructions. Forum facilitates discussion between users and favours this externalization. Moreover forum enables capitalization of the tacit knowledge externalization.

When a user wants to post a question, he must choose a person who can read the question (a particular person or a given group). The forum is dedicated to be used by a group. To choose a group the user has to select the right memory then he has to access (navigation, entry point) to the concept concerned by the question. At this step, he has to access to resources indexed and select the forum type. Then, two possibilities:

A. The question is already posted: he can read answers and complete the resource. For that, he has to click on the question. A pop-up give different information on the question (date of creation, author…) and read the content (answers) in clicking on ‘Visiter’ button (figure 10).
6. Evaluation and feedback

In our approach we have three levels of memory: individual, collective not centralized and collective centralized. In order to assess our approach, we chose to evaluate E-MEMORAE by actors of our two applications. The E-MEMORAE evaluation [Benayache 2004] enables to test the collective and centralized level of our approach. It gave us encouraging results. The test showed that more than 85% of students favour this type of environment and think that E-MEMORAE is a good way to place information at their disposal. The analysis of questionnaires, histories of navigation and report of observers enabled us to know how students navigated within the environment. More precisely, this test enable us to validate our choice:

- Index and structure the contents of a training by an ontology,
- Propose a tree representation of ontology in order to facilitate navigation within the resources,
- Offer a list of entry points in order to enable a fast access to the principal notions of the training.

6.1. Evaluation objectives

These evaluations are not for aim to know if students learn thanks the environment, our main objective was to see how our environment could facilitate learners access to knowledge and favour exchanges within a community of learners. More precisely we wanted to be sure these learners:

- Navigate in different memories: During the evaluation students have a login and a password which enable students to access to the organization memory, their individual memory and their group memory.
- Add new resources in their individual memory or in their group memory: Student can add resources in his individual memory, these resources are accessible only by him. He can also add resources in his group memory, these resources are shared by all group memory members.
- Use forum: Forum enables to a student to ask or answer to a question to his group members or to the organization memory members. This kind of exchange favour the externalization of tacit knowledge.

6.2. Evaluations

6.2.1. Public. A first evaluation was realized by way of an utilisability test during June 2007 with only 16 students of B3I.1 training; few students attended this training at this time. The evaluation lasted only three weeks, until the end of the academic year. A second evaluation began at the beginning of the autumn semester 2007; students (38) who participate to this evaluation study mathematics and are not computer specialists. In concrete terms, the test lasts about three months and has begun in the middle of October 2007.
6.2.2. Protocol. For these evaluations students were grouped by binomial and every binomial had a problem to solve. Each student had during these evaluations an access to the organization memory, his individual memory and his group memory; a group memory was created for each binomial. In each of group memory an entry point was added to allow to access to ontology concept representing the problem. Only login and passwords were given to students. The problem statement was not distributed, students had to access to their group memory, and then reach the concept representing their problem before reading or downloading the resource concerning the problem statement. Each problem has a type which is linked to application ontology concept by the relation: “met-en oeuvre” (to use). This relation enable to reach knowledge concerning by the problem solving and begin the navigation through the ontology.

6.2.3. Questionnaire. For the second evaluation one questionnaire will be distributed at the end of the test. This questionnaire will enable us to collect information concerning students themselves and their opinions about the various aspects of the environment. Most questions are modelled like the following pattern: “Are you agree or not with the statement: x”; students have choice between four answers: not agree / rather not agree / rather agree / agree (Fig 13).

The questionnaire is related to:

- Student profile: this questionnaire part concerns the student initial formation, his aptitude in probability and statistic domains, his use of Internet in order to know for example if student is familiar with Internet. Maybe this part will explain why a student didn’t solve successfully its problem.
- Taking in hand of the environment: this part concerns student feelings about the use of the environment: easy or not, if he appreciated all the environment parts (definition, entry point, navigation in the tree, etc.).
- Presentation of information: in this part we question the student about the notion approach, the structure of tree, the entry points.
- Use of different memories: this part enables to capitalize the student opinion about the use of different memories. Our goal is to know if student appreciates this way to exchange and share knowledge.
- Forum: this part concerns the forum use. We ask student if he posted questions or answers in forum and why. What are his feelings about this kind of resource?

6.3. Feedback.

Though the formation touched its end, we wanted to have a feedback concerning our environment and more especially feedback concerning the access to different memories and the forum. The first evaluation was on a short period and...
during the year-end exam so student don’t really have time to use the environment. A study of navigation history shows that all students reached the problem statement and used the three memories (individual, group and organization). Among those who used environment (10), i.e who did not content to only download the problem statement, all used the relation “met-en-oeuvre” (to use). Students used forum but in view of questions, it was only a test to make sure of its functioning. Finally, five students added resources (essentially web site) on their individual memory, only one resource was added in a group memory. Because the teacher said to students he will not give a mark to the problem solving only two groups delivered a result. Results were considered correct by the teacher.

The first E-MEMORae2.0 evaluation gave encouraging results. Students accessed to different memories, added resources and used the forum. Students seemed to appreciate an environment such as E-MEMORae2.0. Unfortunately the test during was not significant, however observations were encouraging. That’s why a second evaluation has begun and aims to validate our approach.

Here and now, we noted that many students:

- Navigate through the environment and access to different resources.
- Use their different memories.
- Access to the problem statement.
- Access to the problem type and to the useful notions to solve their problem.
- Add resources in individual or group memory, they add principally web site URLs (Fig 14).

For instance just one student (Celine) uses the forum (Fig15). Celine said that she hopes that Rose (the second group member) see the environment and she adds that they must take time to resolve the problem. It is a good use of forum, Celine indexes this topic in the problem notion and explains the subject in the message. You can see that Rose doesn’t response to this question. We think that Rose met Celine in the university and they talk to their problem.

Nevertheless two groups add their proposition to solve the problem (Fig 16). So student solve the problem without use the forum, we think that student work together in the university.

Let’s note that students in mathematics see each other every day and maybe they don’t need to use a forum to ask a question. To finish, we locate this test of E-MEMORae2.0 in a context where communities are not created by practice (binomials are imposed) but have to create their own practice. Now we wait the result of questionnaire in order to know why student don’t use forum.

7. Conclusion

In this paper, we described our approach and we showed how we implemented it in the E-MEMORae2.0 environment for academic applications. Our approach consists in offering a software place to community of practice. Learners will be able to exchange ideas, information about a particular subject concerning their training. Thus, they can learn each other about this subject and then constitute a community of learners. The environment we developed is based on the concept of organizational memory and enables knowledge transfer at three levels: individual, group and organization. A memory is dedicated to each level and the transfer is facilitated by way of the use of a shared ontology. This one enables to semantically define notions to learn and index relevant resources. In such an environment we encourage discussion about notion to learn by way of a forum organized around the shared ontology.

A first evaluation of the environment E-MEMORae2.0 gave encouraging results. Students appreciated to have access to resources indexed by the notion to learn and to add their own resources in their memories (group and individual). They didn’t really use the forum maybe because they see each other everyday during the face-toface training.

A second evaluation is in progress. Currently, students used the environment. They access to their different memories, to the terms of problem, to the notions uses in their problem and they add resources. But they don’t use forum, now we wait for the end of the evaluation to have questionnaire and explain why they don’t use forum.

In order to complete these evaluations, we plan now to make a new evaluation with the students of the Compiègne university. Contrary to the students of the university of Amiens, they don’t have the same timetable and have more difficulty to meet other students so we hope that they use more the tools to exchange knowledge like forum. We also plan to examine to what extent industrial organizations, and companies could benefit of this approach. However it should be noted that software environments are not sufficient to promote organizational learning. It is also a question of culture, as well at university as in any other organization. If students acquire this culture at university, they should get better ready to their professional life.

Let us note however that software environments are not sufficient to promote organizational learning. It is also a question of culture, as well at university as in any other organization. If students acquire this culture at university, they should get better ready to their professional life.

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