Supporting Communities of Learning Practice by the Effective Embedding of Information and Knowledge into Group Activity

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Abstract

Communities of Learning Practice is an innovative paradigm focused on providing appropriate technological support to both formal and especially informal learning groups who are chiefly formed by non-technical people and who lack of the necessary resources to acquire such systems. Typically, students who are often separated by geography and/or time have the need to meet each other after classes in small study groups to carry out specific learning activities assigned during the formal learning process. However, the lack of suitable and available groupware applications makes it difficult for these groups of learners to collaborate and achieve their specific learning goals. In addition, the lack of democratic decision-making mechanisms is a main handicap to substitute the central authority of knowledge presented in formal learning. From the literature, the provision of specific support to informal collaborative learning has, to the best of our knowledge, been little investigated. To fill this gap, we present an ongoing work that will result in a democratic web-based groupware learning system especially designed to provide support for informal collaborative learning over the Internet. Moreover, an important purpose of this software is to provide advanced mechanisms of information management from the group activity for its further use in extracting and providing effective knowledge on interaction behavior. Indeed, this issue represents a fundamental requirement for current collaborative learning environments in order to adequately regulate the learning process as well as to enhance learning group's participation by means of providing appropriate awareness and feedback. In this paper, we describe the main guidelines that conducted the requirements and design of this application as well as introduce the underlying groupware platform, called CoPE, that provides the essential functional support for democratic groupware.

1. Introduction

Computer-Supported Collaborative Learning (CSCL) is an emerging paradigm dedicated to improving teaching and learning with the help of modern information and communication technology [1]. Its main goals are to create virtual environments where all the collaborative learning actors are able to cooperate with each other in order to accomplish a common learning goal. A fundamental requirement to sustain CSCL applications is the representation and analysis of group activity interaction to facilitate coaching and evaluation [2]. Interaction analysis relies on information captured from the actions performed by the participants during the collaborative process. To this end, fine-grained usage data and other complex information collected from the learners' interaction are provided to give immediate feedback about others' activities and about the collaboration in general [2].

Over the last years, collaborative learning needs have been evolving accordingly with more and more demanding pedagogical and technological requirements. To this end, on the one hand, modern pedagogical approaches targeting formal education include advanced learning techniques based on some form of collaborative consensus-building mechanism, such as learning by discussion and problem-based learning. Moreover, from the technological standpoint, a great deal of software packeges in the form of Learning Management Systems (LMS) have recently appeared in the marketplace to enable the management of educational content and also integrate tools that support most of groupware needs, such as e-mail, discussion forums, chat, virtual classrooms, and so on. Representative LMS systems are Moodle and Sakai [3], which are being extensively adopted by educational organizations to help both educators create effective online learning communities, and educational institutions to highly customize the system to suit their pedagogical needs, and technological requirements.

On the other hand, informal collaborative learning is not receiving similar support from both research and technology standpoints and to the best of our knowledge this has been little investigated and exploited. One example is Yahoo groups[1], which provide support to virtual communities for free but they lack of essential groupware features, such as decision-making mechanisms and the provision of adequate feedback. Typically, students meet each other informally after classes in small groups to carry out specific learning activities assigned during the formal learning process. These groups of people form communities of learning practice where an important part of both individual and group learning process takes place and whose members are often separated geographically and have the need to meet asynchronously. However, the lack of appropriate support in the form of software tools makes it difficult for these informal groups to achieve their specific learning goals.

In this paper, we present the main ideas in the form of a software platform to provide virtual communities of learning practice with advanced collaborative support especially designed to substitute the lack of pedagogical support to the learning process, such as the lack of a central knowledge authority and the support to students with poor technical skills. To this end, we present in Section 2 an existing system called CoPE developed by our research group that provides informal support to collaborative work. In section 3 we present the main guidelines of how to extend CoPE to the learning domain by incorporating essential functionalities according to the CSCL paradigm regarding the management of information and knowledge about group activity. Section 4 presents the development of the new platform that aims to provide students with new opportunities of learning outside of the formal education environment. Finally, Section 5 will present the conclusions and ongoing work, especially as to the design of several experiments we are planning to perform in the context of a real virtual learning environment.

2. CoPE: Communities of Practice Environment

CoPE [4] is a web-based collaborative system aiming at providing formal and informal cooperative work over the Internet to non-technical people or those who lack of the necessary resources to acquire such systems. As such, CoPE provides most of the functionality expected from an asynchronous Computer-Supported Collaborative Work (CSCW) [5] application, such as information management and communication facilities.

CoPE is designed to enable a specific type of collaboration; a subset of CSCW that has not been adequately addressed so far. Specifically, this involves sets of individuals who share a need or desire to engage in collaborative production. The object of this production is something that can be codified in documents. CoPE is targeted to individuals who do not already have a formal workflow for this collaboration or who are seeking to improve upon inefficient workflows. CoPE also envisions enabling collaboration among individuals who are part of organizations with formal collaboration mechanisms, but whose mechanisms are limited to intra-organization collaboration. Finally, CoPE is designed to enable *collaboration*, not *management*, and thus envisions "democratic" collaboration.

There are many examples of sets of individuals around the world who have a need or desire to collaborate but lack the resources, knowledge, or institutions to do so. Consider, for example, public school teachers, social workers, and community action groups (where the group and its peer groups are the "individual"). Often these individuals are separated by geography and/or time. They could be too distant from one another to organize face-to-face meetings. They also could be unable to meet due to scheduling constraints or differing work hours. Such individuals may already be part of existing organizations but the "peers" with whom they wish to collaborate are in different organizations. CoPE is especially targeted to the individuals and organizations described here who lack substantial technical expertise or the resources to acquire such expertise. This includes any e-Learning situation for non-technical students.

CoPE is built by modifying and taking advantage of Plone/Zope's [6] powerful content management capabilities, such as information management, document workflow, and so on. CoPE modifies Plone appropriately to achieve the desired functionality.

2.1. Extending CoPE to the e-Learning domain

It has been understood for decades that, while lectures can be pre-packaged, there is no substitute for the interaction among students and teaching assistants in discussion sections. This has always been a problem

[1] Yahoo Groups is found at: http://groups.yahoo.com/

for e-Learning, particularly where barriers of space and time prevent direct meeting.

Essentially any e-Learning system for students not in face-to-face contact must include some means to facilitate communication and interaction among students and instructors about the material. This requirement is the e-Learning analogy of class "engagement." While there are many ad hoc approaches to this task, a democratic CSCW platform such as CoPE seems ideally suited to provide a systematic mechanism for both student-student and student-instructor interactions.

There are several features of the implemented CoPE system that support e-Learning discussions. Most obviously, the facility for hierarchical threaded discussion of documents can serve as a core for group consideration of material of any kind. Through the hyperlink facility, this can include arbitrary additional material. One obvious paradigm is to have the instructor post a document for discussion and to also intervene in the ongoing dialog when appropriate.

The CoPE mechanisms also support the production of joint projects by subgroups of students. It is easy to set up subgroups so that the work of each group is kept private from the others, but is visible to the instructor. Of course, all of the interaction ability is also available to the subgroup. This potentially has an advantage over traditional methods of direct interaction in that the instructor has access to (much of) the process of the group's effort and that this is well-codified for later review and use.

More recently, there has been wide spread use of interactive voting in the classroom. The basic idea is simple - a focused challenging (binary) question is posed to the class as part of a presentation of new material. There are several interesting variations on this theme. It is often useful to have small groups of students discuss the issue before voting. One can also use Delphi like techniques with repeated discussion and voting. This kind of classroom voting has proven to be quite successful and there is even a small industry providing electronic support for these techniques. Of course, the voting mechanisms of a system like CoPE are ideally positioned to extend classroom voting to e-Learning. All of the alternative approaches to this pedagogical technique have natural realizations in CoPE.

There are also mechanisms in CoPE that allow the coordinator of a CoPE site to customize much of the form and content of the material without programming. There is a coordinator's interface (and manual) that provides a range of choices on discussion and voting methods enabling instructors without IT expertise to customize their e-Learning discussion environments.

The extension of CoPE to e-Learning is called Communities of Learning Practice Environment (CoLPE), which will heavily rely on CoPE, and in turn on Plone, for most of the metnioned functionality that intersects CSCW and CSCL paradigms. However, specific behavior has to be aggregated to facilitate both the construction of knowledge among learners and the development of cognitive-acquisition skills, such as problem-solving abilities as well as the provision of an adequate multi-support framework so that tutors and peers can provide a suitable scaffolding when needed, as key aspects that distinguish CSCL from CSCW. CoLPE pursue theses objectives by means of seeing discussion as a medium through which the building and distribution of cognition is effected.

3. CoLPE development

We are currently working on CoLPE to provide full support to both formal and informal learning groups by means of the collaborative discussion process. In this section, we present, first, the CSCL requirements that motivated the CoLPE development and,. then, the main guidelines that conducted the design are described in certain detail.

4.1 General requirements and analysis

A fundamental requirement to sustain CSCL applications is the representation and analysis of group activity interaction to facilitate coaching and evaluation [2]. Interaction analysis relies on information captured from the actions performed by the participants during the collaborative process. To this end, fine-grained usage data and other complex information collected from the learners' interaction are provided to give immediate feedback about others' activities and about the collaboration in general [7]. To this end, in extending CoPE to e-Learning, therefore, a primary requirement is extensive management and provision of information and knowledge in terms of task performance, group functioning and scaffolding [8]. The ultimate goal is to enhance and improve group activity by constantly keeping users aware of what is going on in the system (e.g. others' contributions, new documents created, etc.), In addition, monitoring participants' performance allows tutors to identify problems that participants may encounter during the assignments. These findings can then be used to

provide both real-time and asynchronous support to students (i.e., help students who are not able to accomplish the tasks on their own).

Learning by discussion forms an important social process where participants can think about the activity being performed, collaborate with each other through the exchange of ideas arising, propose new resolution mechanisms, and justify and refine their own contributions and thus acquire new knowledge. Aiming at these important objectives, CoLPE's requirements includes support to the essential types of generic contributions in a discussion process, namely specification, elaboration and consensus [8]. Specification occurs during the initial stage of the process carried out by the tutor or group coordinator who contributes by defining the group assignment and its objectives (i.e. statement of the problem) as well as how to structure the discussion (usually by discussion threads). Elaboration refers to the contributions of participants (mostly students) in which a proposal, idea or plan to reach a solution is presented by means of either contributing in an existing discussion thread or starting a new one. The other participants can elaborate on this proposal through different types of participation, such as questions, comments, explanations and agree/disagree statements. Finally, when a correct proposal of solution is achieved, the consensus contributions take part in its approval (this includes different consensus models, such as voting); when a solution arrives at consensus the discussion terminates.

4.2 CoLPE design

The CoLPE design aims at providing support to the essential types of generic contributions in a discussion process identified in the requirements, namely specification, elaboration and consensus. In CoLPE, these different types of generic contributions are managed by the three essential aspects existing in any CSCL application, namely coordination, collaboration and communication [8]. Specification phase is mainly based on coordination which involves the organization of groups such as workspace organization and group structure and planning, so as to accomplish group objectives. Elaboration phase is based on both collaboration and communication which allow students to share any kind of resources (e.g., participation spaces, documents, etc.) as well as exchange ideas by posting messages to a discussion space. During the elaboration phase, a key issue in CoLPE is that before a participant sends a new contribution to a discussion thread, this contribution is to be categorized by a predefined list of labels or categories, such as request for information, opinion, clarification, elaboration, etc.; inform in terms of extension, suggestion, explanation, justification, illustration, etc.; problem, which may be found as statement, solution, etc; greetings, motivation, among others (see [7] for more details). The purpose of these categories is to classify the intention of the contribution. Not all categories are always made available since depending on where the discussion is found just a subset of them are made available. These categories represent the information source to eventually present complex feedback to users in terms of participation impact and user profile (see further in this section for details). Finally, the consensus phase in the discussion process is also based on collaboration by which a voting system is shared by the group members to choose the best proposal.

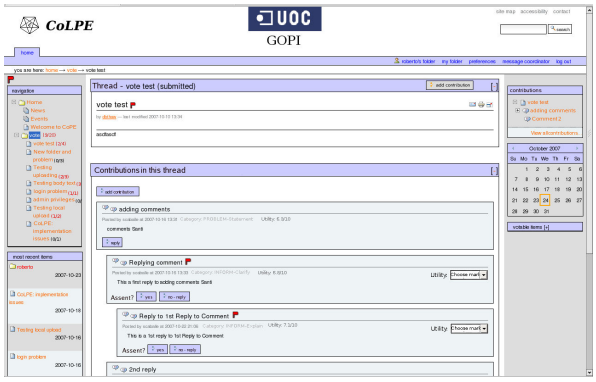

Figure 1. Partial discussion view that shows several contributions in a thread. Each contribution bears information of its category the author chose before submitting it and peers' evaluation on average

During the discussion, participants may access different functionality available at contribution level (see also Figure 1):

- Assentient of contributions: depending on the category of the contributions, certain contributions may be assented positively or negatively by the participant. In case of a negative assenting, the participant is to explain the reason of this decision.
- Reply of contributions. Always it is possible to reply a contribution by everyone (i.e., tutors and students). If there is no need for assent, then a chance to perform a normal reply will be provided.
- Lecturer evaluation on participation quality. Lecturers are to evaluate the content quality of all contributions by reading them and assessing them.

Please note this functionality is addressed to formal education only.

- Peer evaluation on participation utility. Participants may assess others' contributions according to their usefulness in terms of the level of cognition achieved on the topic discussed moving forward in the discussion.
- Reading contributions. In order for a participant to make a read contribution be on record, it is not sufficient to visualize it. An explicit action has to be performed to show such an intention.

All user-resource and user-user interaction in CoLPE generates events or logs which are collected in log files and represent the information basis for the performance of statistical processes addressed at obtaining useful knowledge on the discussion process. This will make the collaborative learning process easier by keeping students aware of what is going on in their workspaces (e.g. others' contributions, the new documents created, etc.) as well as monitoring the general users' behaviour in order to provide appropriate support to them (e.g. helping students who are not able to accomplish their tasks on their own). In addition, this knowledge makes it possible to monitor and control the performance and general functioning of the discussion forum and hence it will enable the tutor to continuously track down the learning process and act if necessary. Finally, in order to efficiently communicate the knowledge achieved from the discussion process to students, will process and analyze the interaction data collected in a way that will provide full support to the presentation of this information in terms of awareness and feedback (see Figure 2).

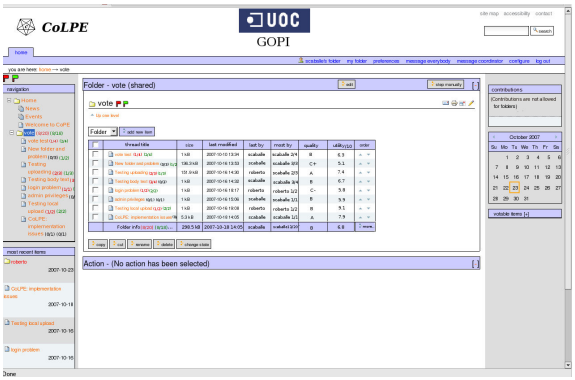

Figure 2. Awareness is shown in the form of flags and numeric information informing about how many news, its type, and where they are located. Partial feedback at thread level is also provided informing of the quality and usefulness of the thread, among other indicators.

Feedback [7] goes one step further than awareness by providing exhaustive information of what is going on in the learning group over a long period of time (e.g. constantly showing to each discussion group member the absolute or relative amount of the contributions of others). CoLPE provides a multi-dimension model featuring activity, passivity, impact, affectivity, and assessment. These general indicators model each student's behaviour and performance and all of them are made available to all students and also tutors for monitoring purposes in both formal and informal context except for those who are applied to a specific context as mentioned (see also Figure 3):

- Activity: Participation behavior indicators are distinguished into proactive, reactive and supportive (or assentive).
- Passivity: Passive participants are considered those who just read others' contributions, as well as the ones who also evaluate the usefulness of these contributions.
- Impact: An impact value is assigned to users to measure the repercussion caused by their contributions to the discussion.
- Effectiveness: The effectiveness value of a move is calculated by the mean value of the number of assent moves received.
- Assessment: Tutor (in formal education) and peer (in both formal and informal education) assessment indicators are to evaluate both the quality of the contribution's content by the lecturer monitoring the discussion process and the usefulness of the contribution by the student participating in the discussion.

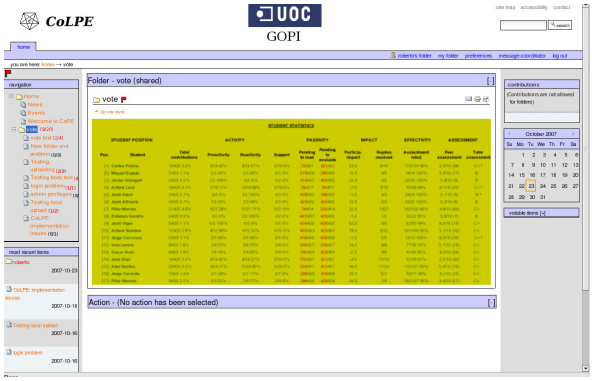

Figure 3. Full feedback information presented to all students. Each student can compare his/her individual performance to the rest of the group.

User and group management is also provided by CoLPE mainly by means of CoPE's resources allowing tutors and group coordinators the management and maintenance of the user data and the learning groups. User and group profile is also to be set up by students to personalize the system according to their needs and preferences, such as personal information, position, language, connection status and so on. In the same way, a module is included to manage and set up the workspaces by assigning them the necessary resources (e.g. agenda, calendar, discussion place, voting system, etc.) so that learning activities can take place.

Finally, security issues will be managed by two main modules: user access (i.e. authentication) and privilege assignment (i.e. authorization) both aiming at restricting groups to accede to others' valuable resources and making tutors easier to track all groups. To this end, CoLPE will rely throughout on CoPE's authentication and authorization mechanisms.

To sum up, the ultimate objective of CoLPE is to fully provide functional support to the discussion process as part of the current pedagogical models in both inside and outside the educational space. Moreover, this application supports the mentioned process of embedding information and knowledge about group activity into the discussion process so as to provide the participants with immediate awareness and constant feedback of what is going on in the discussion.

5. Conclusions and future work

This work is an ongoing but promising effort to help certain learning communities to achieve their particular objectives. In addition, the provision of effective information and knowledge about group activity is a major concern in this contribution since it may enhance and improve the specific type of collaborative learning addressed in this paper a great deal. As such, the main ideas provided in this paper are not conclusive due to its exploratory nature.

Currently, we are about to perform several tests using CoLPE in the real learning context of the Open University of Catalonia (UOC)[2], which provide distance education over the Internet to more than 35,000 students. We plan to provide CoLPE to support both the discussion processes formed in the virtual classrooms and outside of the virtual campus by making this tool available to those study groups who have a strong need for collaborating and achieving their particular learning objectives.

[2] The UOC is found at: http://www.uoc.edu

Acknowledgments

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