Towards Automatic Group Management in CSCL Using Group Contracts

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Abstract
Collaborative learning is today one of the highest stakes in order to improve the effectiveness of e-learning. Learning Management Systems support sometimes the planning of collaborative work and provides tools to carry it out. However, most Learning Management Systems do not fully support the organizational aspects of group work and are mainly based in communication features. In this paper we discuss the main issues of introducing group contracts to support social regulation in computer-supported collaborative learning. Based on this approach, we propose a system architecture which the main attention is given to the group management in order to consider the group itself as a unit of learning.

1. Introduction

To improve effectiveness in distance training, collaborative learning has been used in order to reduce the feeling of being alone and to create a virtual community of learners. For this purpose, the e-learning organization includes collaborative work. Mostly, Learning Management Systems (LMS) platforms do not support the organizational aspects of group work.

In the Computer-Supported Cooperative Work community the discussions are focused in groupware technologies and the respective environments and tools. In the Computer Support for Collaborative Learning community the research for "learningware" possibilities is not a simple addition of the "L" letter. Indeed, the idea is to change the focus from the communication to the learning process itself considering the group.

Work in groupware environments is based on communication, cooperation and coordination. In order to work in a collaborative way the participants must share ideas (to communicate), to organize and integrate themselves in a harmonious operation with the other members of the group (to coordinate) and render their service useful within the whole group (to cooperate) (Bardram, 1998; Fuks et al, 1999).

There is not a unique definition for collaborative learning that is accepted by all the researchers of the domain. This situation was created by the usage of the term "collaboration" with different meanings. Collaborative learning is a situation in which two people or more try to learn something together (Dillenbourg, 1999). Each part of this definition might be interpreted in several ways. The number of learners can present significant variations: pairs, small groups, classes or large communities. To learn something can be interpreted as following a course, performing learning activities (e.g. to solve a specific problem or task), learning through a professional practice (learn from lifelong work practice) etc.

Collaborative learning can be carried out using several interactions strategies: face-to-face or full distant computer-mediated, synchronous or asynchronous. Students may cooperate (each student performs a task) or collaborate (students perform a task in common).

Mainly the unsuccessful cases of distance education using web-based learning solutions are normally assigned to three main factors (Eberspacher et al, 1999): (*i*) a poor follow-up and support by the tutor; (*ii*) the absence of a well-defined schedule of activities and (*iii*) the poor engagement of the students. The two first reasons can be controlled by training the tutor on how to plan and conduct virtual courses, but this also means a directly amount of working time. The third reason, however, is due to the fact that distance learning requires more responsibility and engagement from the students than the traditional classroom (Salomon, 1992). As students have more freedom to execute the scheduled activities, some of them will find higher priority activities in detriment of the distance course.

Our proposal remains in adding group contracts for automatic management of some substantial tutor's work and specially to create and to maintain mutual commitments between users and their working groups. As collaborative learning ideas repose on learning better by learning together, the group regulation using a contract represents a strategy solution effort to respect group commitments in order to do well accomplished learning activities.

This paper is structured as follows. Section 2 discusses related work. Then the Section 3 introduces our approach for automatic group management using group contracts by means of the proposed system architecture and the group contract structure. Finally, in Section 4 we offer a conclusion and indicate some perspectives.

2. Related works

Group management includes a wide range of possible control points, working methods and pedagogical strategies that enable several different architectural and functional approaches. Our work concerns group formation and regulations aspects using roles and rules expressed in terms of a group contract.

In the one hand, in the L^3 project (Lifelong learning as a utility) with the IPoC - Intended Point of Cooperation, Wessner & Pfister (2001) emphasize the integration of collaborative learning into the learning environment so that knowledge about the collaboration context can be used to support the collaboration, principally in group formation.

In the other hand, the "participation model" (proposed by Martel, 1998) takes into account the social aspects of collaborative work. It is a conceptual model to describe joint activities, their relationships of dependence and the structure of exchanges within the group. Besides, this regulation approach has been used and developed by Ferraris et al (2002) to construct collaborative pedagogical situations using scenarios and roles; as earlier presented in the collaborative drawing application for young children (Ferraris & Martel, 2000). This same approach is also used by Mezura-Godoy & Talbot (2001) to propose a framework of regulation components and a component management service for enabling users to develop regulated collaborative applications. The regulation components main features are the rules (work rules, norms and constraints), the types of interactions (synchronous or asynchronous), the tools (regulative or not), the roles (thematic or causal) and the objects (means of communication or product of collaboration).

Considering the notification strategies, Shen & Shun (2002) proposed a flexible notification framework in which notification policy is separated from notification mechanism. In the policy part, they used two parameters, frequency and granularity, to define a spectrum of notification polices. In the mechanism part, separated notification buffers and separated notification executors were used to support various out-going/incoming notification policies.

The works cited above perform certain strategies in group formation, role-based social regulation and notification strategies respectively that give us some perspectives. However, group managing is considered in some level of abstraction that does not allow the execution of automatic services. Our goal is to consider those points and to propose a tailored architecture for automatic group management using group contracts.

3. Automatic group management using groups contracts

Using explicit contracts in CSCL environments will encourage the learners to commit themselves in the learning process. To reach effectiveness, contracts have to be put into practice. We propose an automatic group management service which reminds the users their commitments and applies the terms of the contract.

One of the challenges of the automatic group management service is to provide common features that will be used to monitor, to suggest directions and to take some decisions for the group in a predictive mode. In order to provide self-management capabilities we designed a contract model. This contract is a set of constraints, rules and roles accepted by every group member.

The group life-cycle is composed of four steps, like shown in Figure 1: (*i*) creating the group; (*ii*) adopting a contract; (*iii*) performing and reporting activities and (*iv*) ending the group. For each step, information about user's actions are followed and recorded by the User Workspace module (UW).

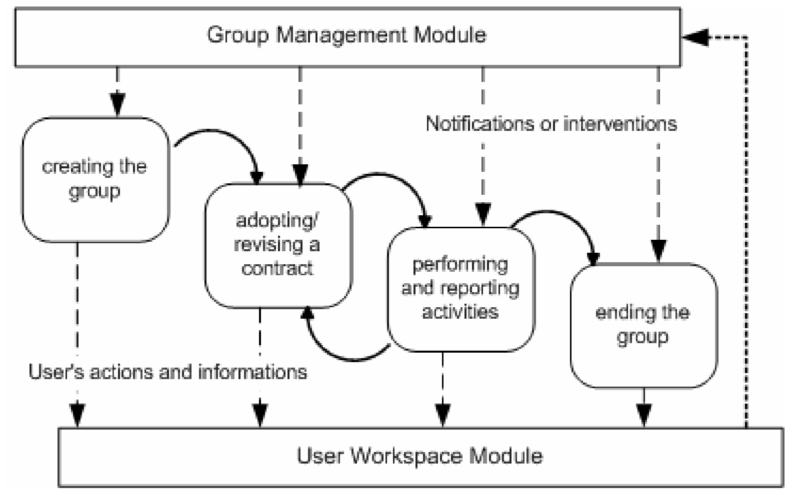

Figure 1. Group life-cycle

The Group Management module (GM) is the service responsible for analyzing the group behaviour and taking some decisions in accordance with the group contract.

The group formation is performed by a best-partner matching search (Inaba et al, 2000). Using the user profile we try to establish well-formed working groups. The rules used to do these matching criteria are described by the tutor or by predefined strategies templates. We can put together users that have quite similar or very distant profiles, according to the users' preferences.

The user preferences are a collection of the user's motivations and learning/working characteristics. This includes personal information like technical skills, availability, leadership qualities etc. Our data model for the user and the group profiles is based on the Learner Information Package specification of IMS Global Learning Consortium (2004). The user profile (user preferences and user behaviour) is automatically created and maintained by the

UW module using the user's log and by filling in some productivity measures based on the accomplished activities.

3.1 System architecture

Figure 2 shows an overview of the system. The GM module and the group profile represent the group view of the system, while the UW module and the user profile represent the individual view of the system. This means that all the users actions are considered individually to update the user model databases, but all the decisions are made considering the group model, i.e. the focus is on the group and their commitments.

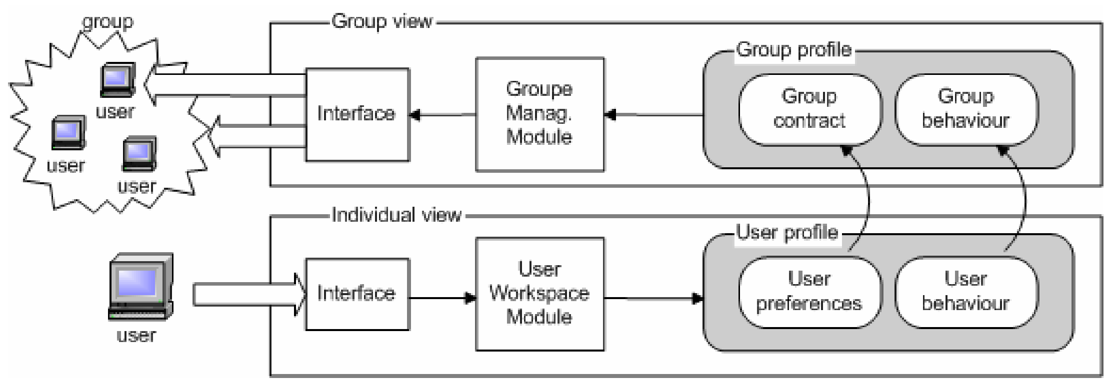

Figure 2. A representation of the system architecture

The GM module is both, time and event driven. Any modification in the user profile starts a respective verification of the respective group contract rules - this is the event driven execution of the inference engine associated with the GM module. There is also a time triggered execution that tries to figure out the activities and supposed assigned task for each participant, according to his role in the group - this is the time driven execution of the inference engine.

As a result of the execution of the GM module, either a notification mechanism previously filled with the adequate message is started or an intervention in the group constitution and group profile is made. Anyway, in extraordinary situations (e.g. nobody agrees with nobody and there are no rules for it) a default message to the group leader, class tutor or system administrator could be send.

3.2 Group contracts

After group creation the members have to adopt a contract (there are some templates available) that represents their mutual engagements and attributed roles and rules to handle their activities according to the established schedule. This role-based approach to social regulation will be the group working guidelines to achieve the group goals.

The contract respect will give some quality indications about the group working. Thereby a disorder in this case could represent a possible group dysfunction or an inadequate contract. When this kind of situation is frequently observed by the GM module a feedback is given in order to avoid a complete group failure.

Figure 3 shows a simplified vision of the contract's sections and a high-level instance exemplification.

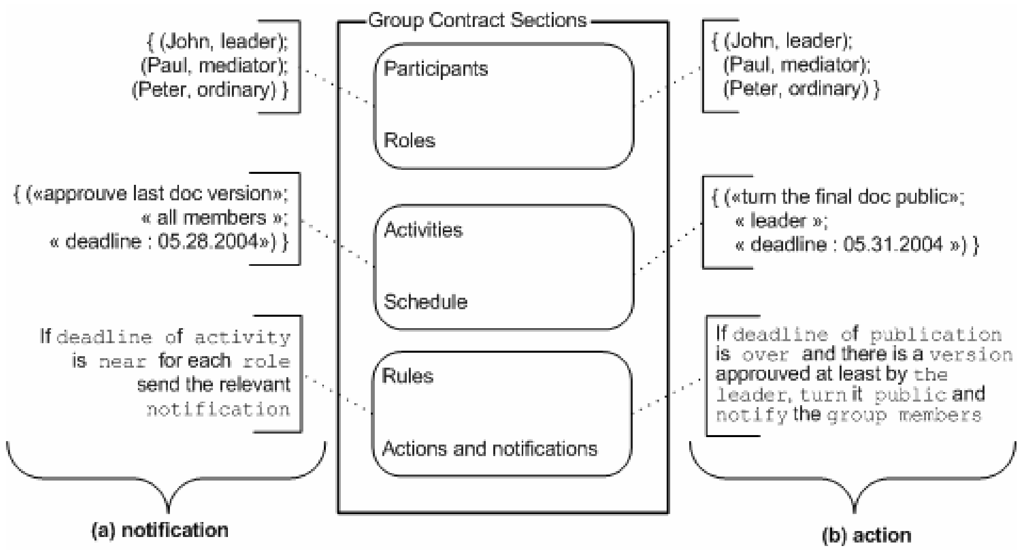

Figure 3. A generic-simplified example of group contract and its practical instance of *(a) notification* and *(b) action*

In part (a) - *notification*: the system requires the approval of the last document version in a specific deadline. In a real situation probably all of them were supposed to ratify their acceptance according to the participation and responsibility degree expressed by their roles. The rules created by the members will be executed by the GM module and following the inference results it will send the relevant notification message reminding the respective role assigned to each group member.

In part (b) - *action*: the rule express a drastic position which is turn any available document version public if at least the leader has approved it (i.e. even if the participants has not), furthermore all the other group members will be notified about this decision. Such a strong rule could be, for instance, an institutional directive that is part of the general working rules that have to be respected in any circumstances.

The Schedule section of the group contract demands some time-triggered actions and notifications that are previously programmed. As a result of this time dependencies between planned activities, the system has to execute a process to review and to maintain the global coherency of activities' interdependence of the planning according to the new inferences. For example, if a member (e.g. Paul) withdraws from the group, the notifications and actions planned for his role (mediator) must be reconsidered. Another example is the situation in which a virtual meeting is cancelled; in this case the upload of the minutes (probably assigned to the role of secretary) and the validation of this draft (assigned to all group members or to the one with the role of leader) need to be erased of the planning.

4. Conclusions and further works

In this paper we have described a proposition for automatic group management using group contracts. The group contract is composed of sections that represents the participants roles, the activities scheduled and the actions and notifications rules associated with each desired commitment between the participants and the group (or institutional) goals.

The strategies chosen for the notification mechanism are more suitable for supporting asynchronous collaborative working. They are domain independent and could be used in a large number of pedagogical experiments in computer-supported collaborative learning.

We are currently implementing the system's kernel dealing with the GM module. This is performed by a constraint language designed to express the contract sections and to associate available templates and scripts with the respective rules. Besides, the knowledge-based system that executes the group contract is also under development.

We are interested in cases where the group work tends to move away from the expectations expressed in the group contract because there is a possibility to use this metrics to revise the adopted contract during the group life-cycle.

One of the challenges in further developments is to turn the GM module into an intelligent service, i.e. provide it with some knowledge of what it knows and what it is doing. This will allow it to help tutors better assist the students and help the group members to better find their collaboration opportunities.

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