Role-based integration of evaluation and regulation in collaborative learning environments

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Abstract. Interaction analysis has become a basic function in the field of collaborative learning, as a means for supporting both *self-regulation* for the students and *formative evaluation* for the teachers. In spite of the fact that these processes rely on the same basic functionalities, there is a lack of proposals or systems that integrate them. This paper presents a research proposal that argues for a role-based approach for the integration of these functions. The experience of awareness systems in CSCW that use roles to decide the type and amount of information they show suggests that this is an appropriate approach. A review of the concept of role in CSCL environments has shown a lack of common vocabulary to describe it and a great diversity of classifications. In order to solve these problems, we have begun to design a framework for the description of roles and we have proposed a new classification of roles which takes into account the dynamic nature of interactions in real collaborative systems. We plan to apply this framework and concepts to the definition of a tool for the analysis of interactions, able to adapt to the changing needs of roles at a given moment. This will eventually lead to the integration of evaluation and regulation support functions in a single tool.

1. Introduction

During the first years the main research efforts within the CSCL (*Computer Supported Collaborative Learning*) field were directed towards the development of CSCL environments. Nevertheless, at present, the evaluation of these systems, and the learning that is promoted with them, are priorities of research in the area. For this purpose, the researches propose the elaboration of powerful tools and methods for interaction analysis for the study of collaboration [1],[2].

Our GSIC (*Collaborative and Intelligent Systems*) group at the University of Valladolid participates in several research initiatives related to the evaluation of collaboration and analysis of interaction. Our group has been interested in the evaluation and the analysis of interactions in CSCL for a number of years. Our main research effort in recent years has focused on the development of a method and tools for supporting formative evaluation in CSCL [3]. This method was oriented to support the evaluation of the collaborative activities once they are finished, in an off-line fashion. The validation of this previous proposal outlined the need of integrating regulation functions, i.e., to provide on-line support to the participants of a collaborative experience while they are collaborating. At present, the group is focusing on the refinement of this method and the tools that support it. More concretely, the work reported in this paper aims at integrating evaluation and regulation processes in collaborative environments.

A revision of interaction analysis tools shows that several proposals exist whose functionalities could be applied for one or another purpose [4],[5]. For example, some

authors state that the information obtained by the teacher with an evaluation tool can be presented to the students to obtain self-regulation [6], as if it were a regulation tool. Nevertheless, these two approaches have so far been considered separately, as it can be observed by the lack of methods and tools that integrate them. However, this distance is not so clear if we consider that both approaches rely on the same basic functions [1],[3]. We argue that the main difference between the two approaches relies on the roles played by the actors to which these functions (and the corresponding tools) are oriented. Then, a tool able to adapt to different roles would be able to perform both functionalities. This leads to the idea that adopting a role-based perspective could help to integrate and extend the functionalities provided by interaction analysis in CSCL.

The rest of the paper is structured as follows: the next section exposes the main objectives and steps established for this research work. Then, section 3 shows the developed work until this moment. The section includes an integrated view of regulation and evaluation in collaborative environments and provides a systematic analysis of the different role classifications found in the literature. Next, section 4 presents the first approaches of research, on the one hand a new classification of roles and on the other hand a framework for describe roles in learning environments. The paper concludes with some open questions and an overview of our future research plans related to these topics.

2. Research purposes

The main objective of this ongoing research is to design and to develop interaction analysis tools capable to integrate evaluation and regulation processes in CSCL environments, taking in account the roles of participants at a given time.

To achieve it, the first step was to analyze the main differences and similarities between regulation and evaluation in CSCL and try to verify their possibilities of integration. As an outcome of the analysis we have argued that the main difference between the two approaches relies on the roles played by the actors to which these functions (and the corresponding tools) are oriented [7]. Then, a tool able to adapt to different roles would be able to perform both functionalities.

Thus, next step of research was to carry out a critical review of the types of roles proposed in the literature, in order to identify the roles that can appear in a collaboration management process together with the requirements that these roles pose to the analysis of interactions [8]. We have detected a lack of common vocabulary to describe roles, multiple definitions and different classifications of roles, many of them domain-dependent. Moreover, the majority of proposals are based on a static approach, that is, the roles are established initially and they ignore the dynamism of learning and the possibility that roles change during the activity.

In order to face these problems, we have begun to elaborate two proposals. On the one hand, we have identified two new dimensions that classify roles according to their appearance in the collaborative process (pre-established and emergent) and according to their variability (static and dynamic). These dimensions help us to identify the roles established before the beginning of activity and to detect the changes of roles during its development. A consequence of this approach is the need to define *indicators* and the values that identify the transitions between the different roles.

On the other hand, we have designing a framework that permits to establish a common vocabulary to define and to characterize roles in learning scenarios. At the same time, we have to go further in the description of the roles that are involved in collaborative learning scenarios, and establish their functional and user-interface needs. These needs will define

the type of support that the different roles will need, which must me achieved by the interaction analysis functions.

Later, with the requirements established in the previous work, we will try to design and develop tools capable to integrate different functionalities depending on the roles that their potential users can play. Initially we take into account the needs of teachers and students in different contexts. This phase will imply to take decisions related to the interaction data representation model, the data analysis techniques and the format for the display of results.

Finally, the supporting tools will be tested in real situations in order to validate them. We plan to apply the proposals to two scenarios in different contexts. We will carry out the validation into different contexts: An asynchronous scenario, with university students and a synchronous environment, with students of secondary school.

3. Developed work

This section presents the results obtained from the work carried out up to this moment. They include the study of the possibilities to integrate regulation and evaluation processes, and the review of roles in learning systems into the literature.

3.1 Possibilities to integrate regulation and evaluation processes

To achieve our main objective of research, the first step was to analyse the main differences and similarities between regulation and evaluation in CSCL and try to verify their possibilities of integration. We have compared *the collaboration management cycle* [1], a generic framework of the systems oriented to scaffolding that support the collaboration, with *the extended cycle of collaboration management* [3], that include the aspects related to the evaluation support systems. We can state that both activities (i.e., regulation and evaluation) rely on the same basic functions. Moreover, these two approaches have so far been considered separately, as it can be observed by the lack of methods and tools that integrate them. We argue that the main difference between the two approaches relies on the roles played by the actors to which these functions (and the corresponding tools) are oriented (i.e. regulation to students, evaluation to teachers). This leads to the idea that adopting a role-based perspective could help to integrate and extend the functionalities provided by interaction analysis in CSCL [7]. A similar approach can be found in the effort to adapt awareness tools to different users in the CSCW field [9],[10]. From the experience of these systems we can state that the collaborative learning tools in would benefit from considering this aspect, in order to improve the collaborative processes in genuine environments. The problem would consist of detecting the needs of the participants in every moment, i.e., what information is needed and how it will be showed. Thus, a critical review of the types of roles proposed in the literature is necessary in order to identify these needs. Next subsection presents an outline of the main conclusions obtained after this review.

3.2 A review of roles in learning systems

We have done a revision of works that study the roles in fields related to collaborative learning scenarios, including CSCL, CSCW, e-learning, classroom-based research, group dynamics and adaptive hypermedia environments [7]. We have detected a lack of common

vocabulary to describe roles, multiple definitions and different classifications of roles, many of them domain-dependent.

We have detected that there is a rather high consensus with respect to the generic roles that can be identified in a learning scenario, such as the teacher, the student, the designer, etc. In this generic classification the categories proposed by different authors are similar ([11],[12], [13],[14],[15],[16]).

On the contrary, this review shows that teachers' and students' roles depend very much on the approach and on the context of each work, and that there is no such consensus between the different authors ([13], [17], [18], [19], [20], [21], [22], [23], [24]). For example, while [17] includes the next teachers' roles: "facilitator, creator of consensus, animator, event of changes and supervisor'', [22] considers the "facilitator, designer, technician, evaluator, and administrative", and [19] "facilitator, guide and co-learner".

Also we have found divergences on the description of the functionality and needs of the same role. For example, [17] states that "the facilitator must create learning situations and improve the motivation of learners", but [18] considers that "they monitor the collaboration activities within a group, detect problems and intervene". Moreover, the majority of proposals are based on a static approach, that is, the roles are established initially and they ignore the dynamism of learning and the possibility that roles change during the activity.

4. Initial results

This section presents two initial proposals obtained from the work described in the previous section. On the one hand, we have identified a new classification of roles that takes in account dynamic aspects of learning, and, on the other hand, we have begun to design a framework for the description of roles in learning environments.

4.1 Towards a framework to define and describe roles in learning systems

It is necessary to establish a common vocabulary to define and to characterize roles in learning scenarios. In this line we have begun to design a framework that initially would have these four dimensions: actor, functions, needs and indicators.

An ***actor*** represents a generic role, that is, a human, an agent or any combination of them [15]. (i.e., the *teacher* and the *student* roles have been pre-established roles in a traditional classroom [18]).

A ***function*** is a characterization of an actor. With a function we could specify their activities, duties and responsibilities (i.e., as a *facilitator*, a teacher perform a minimal pedagogical intervention in order to redirect the group work in a productive direction or monitor which members are left out of the interaction [25]).

A ***need*** is a requirement for each pair role-function. These requirements relate to the necessary information (amount and type) and the functionalities of tools, and they are influenced by diverse parameters related to the context, as the scenario or educative level of students. For example, the interventions of the teachers will be produced on-line in a synchronous scenario, while in a asynchronous system these interventions can be produced by the next session, when the teacher may have studied previously the student's dialogue and action based interactions [2]. If we refer now to the educative level, we can state that the type and amount of information that will need a K-12 student will not be the same than the needed by a high-school student, for example [8].

An ***indicator*** is a parameter that helps to identify the transitions between the different roles. Each indicator is composed by a dimension name and the values that delimiter one possible change of role. The values can be different depending of the specific context.

4.2 A proposal of classification of roles that considers dynamic aspects of collaboration

We have identified two dimensions that classify roles takes in account the dynamic aspects of collaboration. Regarding *the moment of their appearance* we define **pre-established** and **emergent roles**. *Pre-established roles* are those that are assigned before the beginning of the collaborative activity (for example by task or by position in organization). *Emergent roles* are those that are not assigned in advance, but that appear spontaneously during the development of the activity [26].

According to their *variability* we define **static** and **dynamic roles**. *Static roles* are those that remain invariable from the moment of their appearance until the collaborative activity finishes. *Dynamic roles* are those that vary during the development of the collaborative activity, either due to a rotation of roles among the members of group, or because a change of task results in the assignment of new roles, or because the new roles arise spontaneously.

As a consequence of this approach, we can see that it will be necessary to define *indicators* and the values that identify the transitions between the different roles. These results in a two-way relationship between roles and analysis of interactions. First, analysis of interactions helps to identify roles, and then, these roles (i.e., the people representing them) will be supported by interaction analysis functions. So, this will lead eventually to the integration between regulation and evaluation based on the analysis of roles.

5. Conclusions and Future Work

This paper has presented the possibilities for the integration of evaluation and regulation processes in CSCL with a role-based approach. Motivated by existing proposals of awareness systems in CSCW, we have presented the need of considering roles when designing tools and systems for interaction analysis, in order to develop systems capable to integrate different functionalities depending on the roles that their potential users can play.

An initial review of the concept of role in the literature has shown many different definitions of this term and very diverse classifications, the majority of which are very domain-dependent and ignore situational dynamics of learning. Due to this diversity, we have initiated two new approaches. On the one hand, the identification of two dimensions that classify roles according to their appearance in the collaborative process (pre-established and emergent) and according to their variability (static and dynamic). These dimensions help us to identify the roles established before the beginning of learning activities and to detect the changes of roles during its development. On the other hand we have begun the design of a framework for description of roles in learning environments.

We have to advance in the description of the roles that are involved in collaborative learning scenarios and establish their functional and user-interface needs. These needs will define the type of support that the different roles will need, which must me achieved by the interaction analysis functions. Moreover, we have to define indicators and the values that identify the transitions between the different roles. At same time we should decide other questions as the results representation form, aspect directly related to the interface needs of users. Once it obtained this, we will begin to design and to develop tools for these purposes. Finally, the developed tools will be tested with real users in order to validate them.

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