Self-regulation in ACT: A case study in peer-assessment activities

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Abstract: Having as an objective to support students in collaborating/communicating fruitfully with respect to the underlying collaborative learning setting, we developed ACT, a synchronous communication tool which supports mechanisms for students’ self-regulation as well as for the adaptation and personalization of the communication. The self-regulation mechanism enables the diagnosis and the evaluation of students’ collaborative behavior both at the cognitive and social level and provides feedback at awareness, metacognitive and guiding level. The use of ACT in the context of a peer-assessment activity showed that the tool can help students in self-regulation and improve their collaboration behavior.

Introduction
Current trends in educational practice emphasize the social dimension of learning and consider assessment as one of the most powerful educational tools for promoting and motivating effective learning (Pellegrino, Chudowsky, & Glaser, 2001; Vosniadou, 2001). Regarding assessment, the exploitation of alternative methods such as peer-assessment may make the assessment process a valuable learning experience (Dochy & McDowell, 1997). In peer-assessment, the author and/or the assessor may be individual or group of learners. In a computer-based educational setting, it is crucial to support and sustain productive collaboration/communication and appropriate communication means are required to support group members to productively collaborate and propose, articulate, evaluate and refine their ideas.

The structuring and regulatory approaches contribute to the development of tools that support and guide students in the development of communication skills and in having a fruitful collaboration (Jermann, Soller, & Lesgold, 2004). In the context of text-based synchronous communication, the structuring of the collaborative process is achieved following the structured dialogue which is implemented through sentence openers. Researchers state that different forms of dialogue could be more appropriate for different kinds of activities and the available communication means could possibly be tailored to the underlying learning setting (Lazonder, Wilhelm, & Ootes, 2003; Soller, 2001). As far as the regulation approaches are concerned, current research efforts focus on the design and implementation of interaction analysis (IA) indicators that mainly concern the social dimension of collaboration and the provided feedback is given at one level i.e. awareness or metacognitive or guiding level (Dimitrakopoulou et al., 2005). In the literature of the feedback field and educational practice, it is stressed that feedback should focus on student’s progress, provide guidelines for improvement and be available in alternative forms and levels in order to cover the diverse students’ preferences and abilities (Mason & Bruning, 2001; Vosniadou, 2001).

Our efforts aim to extend research in the CSCL field, by developing a synchronous communication tool with adaptive capabilities, called ACT (Adaptive Communication Tool) in order to support and promote students’ collaboration/communication. In ACT, the collaborative learning setting includes the activity, which may have one or more subactivities and the collaboration model, which determines the number of the group members, whether group members are going to collaborate having the same duties or undertaking different roles, the duties of each role and the role that each member undertakes as well as who is going to act as the moderator of the group. The collaborative activity serve a specific learning goal, which is further analyzed to outcomes of Comprehension, Application, Checking-Criticizing and/or Creation level. ACT supports both the free and the structured form of dialogue; the structured dialogue is implemented either through sentence openers or communicative acts (the term Scaffolding Sentence Templates (SST) is used for reference both to sentence openers and communicative acts). Each SST belongs to a specific discourse category (e.g. Proposal, Opinion). ACT supports an adaptation mechanism of the communication taking into account the expected learning outcomes of the activity and the collaboration model followed. More specifically, the adaptation is realized at two levels (i) at the level of proposing the form of dialogue and the SST type that are considered more appropriate, and (ii) at the level of providing the most suitable set of SST in case of structured dialogue (Gogoulou, Gouli & Grigoriadou, 2008). Moreover, ACT enables students to negotiate on the form of dialogue and the SST type they prefer to use. Also, during their communication, students have the possibility to define their own SST in case the available ones do not cover their needs (Gogoulou et al., 2008). The students’ defined SST are part of their student model and become available each time they use the ACT tool.

The paper focuses on the self-regulation mechanism and presents an experimental study conducted in the context of a peer-assessment activity.
Framework for self-regulation in ACT

A new direction that has emerged recently is interaction analysis, which provides information directly to students to self-assess their activity. Students need: (i) support on the awareness of their own individual or collaborative activity, and (ii) external assessment of their activity and their product (Dimitracopoulou et al., 2005). Supporting them on a metacognitive level could give them the means to self-regulate their own activity during a session or during forthcoming sessions. The interaction analysis and feedback provision process, designed and implemented in the context of ACT, (i) takes into account the collaborative learning setting followed (i.e. the expected learning outcomes and the model of collaboration followed), (ii) supports a framework for the diagnosis and the evaluation of students’ collaborative behavior both at the cognitive and social level, (iii) provides feedback at awareness, metacognitive and guiding level, and (iv) gives expert the possibility to tailor various parameters with respect to the goals of the underlying setting. More specifically, a set of indicators have been developed:

- the Participation Analysis Indicator: provides statistical information at student and group level concerning the discourse categories (e.g. Proposal, Reason, Question) of the SST that student/group has used,
- the Cognitive Skills Indicator: gives an estimation of student’s behavior, at student and group level, with respect to the expected learning outcomes of the activity and the role that the student has undertaken,
- the Initiating the Discussion Indicator: concerns student’s attitude in initiating/stimulating the discussion by making proposals or expressing an opinion,
- the Advancing the Discussion Indicator: reflects student’s behavior in advancing the discussion in terms of (a) answering to his/her interlocutor’s messages (Requested Answer Indicator), (b) elaborating further on his/her interlocutor’s contribution (Optional Answer to Others Indicator) e.g. in case that his/her interlocutor expresses his/her agreement or makes an inference, the student may attempt to comment on this or ask a question, and (c) elaborating further on his/her own personal opinions or inferences (Optional Elaboration to Learner’s own view Indicator),
- the Further Elaboration on Interlocutors’ view Indicator: reflects that student not only acknowledges his/her interlocutor’s point of view but also wants to stress and elaborate further on the point under discussion (e.g. s/he not only agrees but also argumentates on her/his agreement), and
- the Promoting the Discussion Indicator: shows student’s collaboration behavior in participating in a creative discussion. The Initiating the Discussion Indicator, the Advancing the Discussion Indicator and the Further Elaboration on Interlocutors’ view Indicator partially contribute to the Promoting the Discussion Indicator with respect to the corresponding weights assigned by the instructor reflecting the degree of importance of each indicator in the context of the specific learning activity.

The feedback is provided at awareness, metacognitive and guiding level in textual and graphical form in order to (i) cover the diverse students’ needs, abilities and preferences, and (ii) develop students’ critical thinking, self-reflection and self-regulation abilities (Dimitracopoulou et al., 2005; Vosniadou, 2001) The provided feedback informs students about their behavior, explains how the system has reached the specific estimation and guides students appropriately by providing clues in improving their behavior. More specifically, at awareness level, the Participation Analysis Indicator, for student and group, is presented in graphical form.

- at metacognitive level, the Cognitive Skills Indicator at student level, the Initiating the Discussion Indicator, the Advancing the Discussion Indicator, the Promoting the Discussion Indicator (Figure 1) and the Further Elaboration on Interlocutors’ view Indicator are presented in textual form aiming to inform student about
his/her behavior, explain the system’s estimation and give hints for improvement. The Cognitive Skills Indicator at group level is presented in graphical form, enabling student to become aware of his/her behavior as well as of his/her interlocutor’s behavior. Finally, the Requested Answer Indicator is presented in graphical form through the Dialogue Tree where the messages are presented according to their reference message and those messages considered as unanswered are annotated for each group member.

- at guiding level, the Personal Guide, tries to examine each member of the group in relation to his/her collaborators and gives guidelines both for the student under consideration and for his/her interlocutors in the direction of having a fruitful collaboration; it takes into account student’s attitude in initiating the discussion and answering to his/her collaborators’ messages as well as student’s behavior with respect to the expected learning outcomes of the activity.

### Experimental Study: Using ACT in peer-assessment activities

The ACT tool was used during the winter semester of the academic year 2006-2007 in order to support the synchronous communication of students while working out peer-assessment activities in the context of the undergraduate course “Didactics of Informatics” at the Department of Informatics and Telecommunications of the University of Athens. One of the primary objectives in the use of ACT was to examine the following two research questions: (i) What is the students’ opinion about the self-regulation mechanism? Do they believe that the provided feedback can influence their behavior? (ii) Does the self-regulation mechanism affect students’ behavior? What behavior patterns are detected?

Twenty four students (n=24: 12 groups of two students) participated in the study. Initially, the students answered a brief questionnaire aiming to elicit their experience in using chat tools and CSCL environments. Their answers revealed that they had little or no experience in using such environments. The students were randomly assigned to the experimental (n1=16: 8 groups of two students) and the control group (n2=8: 4 groups of two students); the control group was initially consisted of 12 students but four of them (2 groups) dropped out the lesson after the 3rd phase. The whole process was consisted of the following phases: (1) 1st phase: introduction to ACT tool (1st week): The functionality of ACT was demonstrated to all students, (2) 2nd phase: familiarization with ACT (2nd week): All students worked out several activities where they had the opportunity to use the sentence openers and the communicative acts and navigate in the available facilities, (3) 3rd phase: familiarization with the assessment process (3rd week): All students had to use the tool in dyads in order to work out an activity which asked them to define assessment criteria and evaluate a given lesson plan, (4) 4th phase: working out the peer-assessment activity (4th – 6th week): in the authoring phase of the peer-assessment activity, the students worked individually; each of the 24 students designed a lesson plan for a given subject and submitted it to the instructor via e-mail. In the evaluation phase, the students in dyads had to evaluate two anonymous lesson plans collaborating synchronously using the ACT tool. The students communicated in structured form using either sentence openers or communicative acts. 4 out of the 12 groups worked in distance while the rest 8 groups participated in a lab session for about 4 hours; each student in lab was working on his/her own computer communicating with his/her collaborator via ACT. The recorded dialogues were processed in order to delete any words indicating the evaluators’ identity and sent back to the corresponding author in order to proceed to any improvements/changes following the evaluators’ suggestions.

During the 3rd and 4th phase, the experimental group could access all the functionalities related to the self-regulation mechanism while the control group had no such facility available. At the end of the process, the experimental group had to answer to open and closed questions about the self-regulation mechanism (e.g. Do you think that the provision of the feedback information is useful? Do you understand the feedback?).

Qualitative and quantitative data were obtained and analyzed: (i) students’ answers to the questionnaire, (ii) values of IA indicators, (iii) students’ dialogues, and (iv) system log files recording students’ actions.

### Results

1st Research Question: What is the students’ opinion about the self-regulation mechanism?

Do they believe that the provided feedback can influence their behavior?

Regarding the first research question, students’ answers to the questionnaire were analyzed. In particular, as far as the usefulness of the provided self-regulation facilities are concerned, the Dialogue Tree stands high in students’ preference (92,3%) while at the lower position are the Cognitive Skills Indicator and the Participation Analysis Indicator (69,2%). Regarding the understandability of the provided feedback, students seem to have no problems (69,2% for the Cognitive Skills Indicator, 88,5% for the Promoting the Discussion Indicator and 84,6% for the Personal Guide). Also, students have positive view for the adequacy of the provided feedback, mentioning that it is not necessary to provide additional information. Regarding the content of the provided feedback, students consider particularly useful (92,3%) the explanation given for the discourse categories as
they can understand how the system reached the specific estimation and the available clues about what they can do to improve their behavior. Considering the presentation form of the provided feedback, students are aligned with the supported forms (84.6% for the Cognitive Skills Indicator, 92.3% for the Promoting the Discussion Indicator and 92.3% for the Personal Guide). As far as their agreement to the system’s estimation is concerned, the majority of them consider the estimations and the hints in the correct direction (61.5% for the Cognitive Skills Indicator, 65.4% for the Promoting the Discussion Indicator and 69.2% for the Personal Guide), commenting that the tool can estimate the intention of their contribution and not the real content – therefore some of them are quite cautious and rate the system’s estimation as indifferent. Regarding their belief about whether the provided feedback influenced their behavior, students believe that they tried to take into account the feedback (57.7% of the students mentioned that the Participation Analysis Indicator influenced their behavior, 53.8% for the Cognitive Skills Indicator, 65.4% for the Promoting the Discussion Indicator and 57.7% for the Personal Guide). The analysis of students’ answers revealed two trends as far as students’ preferences about the provided feedback is concerned (i) there are students that prefer to have access to graphical form of feedback such as the Dialogue Tree and the Participation Analysis Indicator, and (ii) there are students that prefer to have at their disposal analytical information presented in textual form such as the Cognitive Skills Indicator, the Promoting the Discussion Indicator and the Personal Guide.

2nd Research Question: Does the self-regulation mechanism affect students’ behavior? What behavior patterns are detected?

In order to investigate whether the provided feedback influences students’ behavior, the values of all indicators were examined both for the experimental and the control group. The sum of the indicators’ value per message for all members of each group was calculated. Also, the average value for the Cognitive Skills Indicator and the Promoting the Discussion Indicator was estimated. Figure 2 presents the Cognitive Skills Indicator while Figure 3 presents the Promoting the Discussion Indicator. The value of the Cognitive Skills Indicator for the experimental group is at a continuous progress and finally outweighs the control group. Regarding the Promoting the Discussion Indicator, both groups seem to improve their behavior with the experimental group to excel. Similar results stand for all the indicators, that is the values for the experimental group are on increase. From the above, it becomes apparent that the provided feedback influences students’ behavior and has positive results in improving students’ behavior and in having fruitful collaborations. The evolution of the indicators values is aligned with the students messages as these are recorded in the system’s log files. The examination of students’ dialogues and actions recorded in log files reveal that students tended to follow the provided hints and improve their behavior in most cases. Indicative examples that illustrate this attitude are presented in Table 1.

![Figure 2. The evolution of the Cognitive Skills Indicator during message exchange.](image)

![Figure 3. The evolution of the Promoting the Discussion Indicator during message exchange.](image)

<table>
<thead>
<tr>
<th>Feedback</th>
<th>Student’s reaction</th>
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<td>The following feedback was given to one of the G2 group members: “Try to express your personal opinion using sentence templates such as proposal or opinion. You should urge your interlocutors to do so. It is important that all group members participate actively in the dialogue. You should also answer to your interlocutors’ messages. You can access the Dialogue Tree and see which messages you should answer.”</td>
<td>The student answered to one of her interlocutor’s message and then tried to encourage her interlocutor to express his opinion: 47. std0: Agreement [ 46/std1] : OK. 48. std0: Question :Don’t you think that the evaluation sheet is quite long? !? !? !? !? !</td>
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<td>The following feedback was given to one of the G4 group members: “You should also answer to your interlocutors’ messages. You can access the Dialogue Tree and see which messages you should answer.”</td>
<td>The student expressed his opinion after articulating his opinion</td>
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Table 1. Examples of dialogues and students’ actions illustrating students’ attitude to the provided feedback
group members through the Cognitive Skills Indicator: “... you rarely use sentence templates that denote Proposal, Opinion, Reasoning or Explanation”

agreement to his interlocutor’s point of view:

28. std0: I agree with [27.std1 ]and I propose to mark this criterion with 10%.

29. std0: I propose to go on to the next criterion. I believe that it should concern whether the lesson plan addresses all the predefined learning outcomes.

The following feedback was given to one of the two G6 group members through the Promoting the Discussion Indicator: “You don’t try to express your opinion and initiate the discussion. You rarely use sentence templates such as Proposal and Opinion.”

The student expressed his agreement to his interlocutor’s message and then tried to articulate his personal opinion:

10. std0: Agreement [ 9.std1] :Yes, I think it is OK.

11. std0 : Opinion and Argument : For the third criterion, I think that the question is quite good and the use of the teaching method of lectures before EClIP is good enough.

Summarizing the results, the following patterns in students’ behavior were detected:

• There are students that tend to activate all indicators, following the hints/advice of the current feedback. This category of students tended to access the Personal Guide at first place and then access the rest indicators following the given hints.

• There are students that show their preference to feedback (indicators) presented in graphical form such as Dialogue Tree and Participation Analysis Indicator.

• Some students activate very often the feedback functionalities trying to find out whether the system estimation changes as result to their behavior, while there are students that activate the specific functions only a couple of times during the dialogue.

• In general, students try to take into account the provided feedback especially in cases of unanswered messages or limited expression of personal opinion.

It is worthwhile mentioning, that the performance of the experimental group in the specific assignment (the average score was 7 in ten-scale) was higher than that of the control group (the average score was 5,8).

Conclusions and Future Plans

The use of ACT in the context of a peer-assessment activity showed that the supported self-regulation mechanism can help students in self-regulation and improved their collaboration behavior. The students seem to take into account the provided feedback and attempt to change their behavior. However, we believe that the use of ACT for longer periods of time is necessary in order to investigate how students behave and use the supported adaptation and self-regulation mechanisms in the context of various activities. Also, we plan to enhance the adaptive capabilities of the tool taking into account the interaction behavior of students and their preferences.

References


