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ACT: A Web-Based Adaptive Communication Tool

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Abstract. This paper presents a web-based adaptive communication tool, called ACT. ACT supports and guides the learners' communication/collaboration by implementing the structured dialogue either through sentence openers or communication acts. The scaffolding sentence templates are adapted according to the cognitive skills addressed by the learning activity, the model of collaboration followed and the educational tool used. The learners have the possibility to personalize the communication/ collaboration process by enriching the provided set of the scaffolding sentence templates with the desired ones and to monitor their debate in a visual graphical representation form through the Dialogue Tree. The first empirical results are encouraging regarding the predetermined set of the scaffolding sentence templates and their proper use, the adaptation framework supported, the provided facilities and the coherence of the dialogue.

Keywords: Communication, structured dialogue, sentence openers, communication acts, scaffolding sentence templates, adaptation, Dialogue Tree

INTRODUCTION

Peer interaction is acknowledged as a significant factor in collaborative learning. However, the learners do not necessarily have the desired productive collaboration/communication skills (e.g. provide explanations, ask questions, engage in argumentative discussions) (Lazonder, Wilhelm & Ootes, 2003; Soller, 2001). Structuring approaches aim to create appropriate conditions by designing and scripting the collaboration framework before the interaction begins (Andriessen, Baker & Suthers, 2003). In this context, the structuring of the dialogue is used as an approach to encourage and guide learners to certain types of communication (Andriessen, Baker & Suthers, 2003). The structured dialogue may follow a fully or semi-structured form implemented through sentence openers or communications acts, enabling learners to compose their message and denote their underlying intention by using predetermined *Scaffolding Sentence Templates* (SST).

Results from various research efforts indicate that the use of the structured dialogue supports and increases learners' task-oriented behavior, leads to more coherence in discussing argumentatively the subject matter, promotes reflective interaction, lightens the learners' typing load, guides the sequence and the content of the dialogue, enables the monitoring and the interpretation of the ongoing discussion and is characterized as an adequate pedagogical approach for virtual learning groups (Baker & Lund, 1997; Soller, Lesgold, Linton & Goodwin, 1999; Hron, Hesse, Cress & Giovis, 2000). However, the potential improper use of the SST and the restriction of the learners' choice of words imposed by the structured dialogue are two disadvantages to be taken into account during the development of synchronous communication tools (Lazonder, Wilhelm & Ootes, 2003). According to Lazonder et al. (2003), the SST should be derived from naturally occurring online text-based free dialogues while Soller (2001) states that it is important to provide the widest and most appropriate range of SST.

A number of synchronous communication tools have been developed (either integrated in a CSCL environment or as standalone tools) to support the dialogue through a structured communication interface. In BetterBlether (Robertson, Good & Pain, 1998), the communication interface consists of sentence openers, which support the skills of good communication, trust, leadership and creative conflict. The communication tool of the LeCS environment (Rosatelli & Self, 2002) provides a set of sentence openers, which facilitates the process of reaching an agreement, while specific expressions enable learners to express their emotional state. The communication tool of the EPSILON environment enables learners to communicate through sentence openers which are classified to categories according to the Collaborative Learning Conversation Skills Taxonomy (Soller, 2004). ALEX (Hirsch, Saeedi, Cornillon & Litosseliti, 2004) is a structured dialogue tool, which enables learners to make arguments by selecting and completing partial sentences (sentence openers) and facilitating learners to make references to already sent messages. Jermann and Schneider (1997) in their tool called

Conference MOO, support both the free-text and the structured dialogue; the structured dialogue is implemented through four buttons (e.g. "I don't understand") and four sentence openers (e.g. "I propose"). They assert that the learners' preference on a specific dialogue mode (free or structured) depends on the particular content type (i.e. task, strategy and interaction management). Also, the Co-Lab tool (Lazonder, Wilhelm & Ootes, 2003) supports the free-text and the structured dialogue. All these tools support the implementation of the structured dialogue through sentence openers and provide a fixed set of SST regardless of the context of the collaborative activity and the collaboration framework followed. Moreover, they provide limited degree of personalization (i.e. few tools enable learners to select between the structured and the free form of the dialogue).

Our research efforts take previous work in structuring the dialogue in synchronous communication tools one step further, by attempting to:

(i) implement the structured dialogue either through sentence openers or communication acts depending on the learning outcomes (i.e. cognitive skills) addressed by the collaborative activity and the model of collaboration followed by the group members,

(ii) provide the most meaningful and complete set of SST adapted according to the collaboration framework followed in the collaborative activity (i.e. the cognitive skills addressed by the collaborative learning activity, the model of collaboration followed and the educational tool used), and

(iii) offer learners the possibility to personalize the communication/collaboration process by enriching the provided set of the SST with the desired ones.

To this end, we developed a synchronous communication tool with adaptive capabilities called ACT (Adaptive Communication Tool). The learners can monitor the dialogue progress and reflect on their communication/collaboration by accessing the Dialogue Tree as well as the results of the quantitative analysis of their debate at any time during the elaboration of the activity. The first results revealed from the formative evaluation of the ACT tool are encouraging regarding the predetermined set of the SST and their proper use, the adaptation framework, the provided facilities (the monitoring of the dialogue through the Dialogue Tree and the enrichment of the SST) and the coherence of the dialogue. Moreover, they drew useful implications concerning the way the SST are provided to learners as well as the adaptive and adaptable capabilities of the ACT tool.

The rest of the paper is structured as follows. In the following section, we present in detail the functionality of the ACT tool in terms of the SST provided, the adaptive capabilities supported, and the facilities provided to the learner. Afterwards, we discuss the results from a study that we conducted in the context of the formative evaluation of the ACT tool. The paper ends with the main points of our work and our near future plans.

THE ACT TOOL

ACT was developed in the context of a web-based adaptive collaborative learning environment, referred to as SCALE (Supporting Collaboration and Adaptation in a Learning Environment) (Grigoriadou, Gogoulou, Gouli & Samarakou, 2004). The SCALE environment follows the conceptual framework of the Activity Theory (Engeström, 1987; Cole & Engeström, 1993) and supports (a) *the individualized learning*: enables learners to work on learning activities, provides personalized feedback and guides/supports learners during the elaboration of the activity through pedagogical agents, (b) *the collaborative learning*: enables learners to work on collaborative learning activities, supports the group formation of the learners based on their individualized characteristics and the characteristics of the activities, supports alternative models of collaboration between the group members, promotes and facilitates the synchronous communication between the group members, and guides the learners at the communication and at the learning level through pedagogical agents, and (c) *the assessment process*: supports the automatic assessment of the activities, the collaborative assessment and the peer assessment and provides feedback tailored to learners individual characteristics and needs.

The ACT tool can run as a standalone communication tool or in the context of the SCALE environment, supporting the synchronous communication of the learners in groups of up to four persons. The learners communicate in the context of a specific collaborative activity which addresses cognitive skills that are classified to one of the four levels: *Comprehension level* (Remember + Understand), *Application level* (Apply), *Checking-Critiquing level* (Evaluate) and *Creation level* (Analyze + Create) (Gogoulou, Gouli, Grigoriadou & Samarakou, 2004). Moreover, a specific model of collaboration is followed during the elaboration of the activity; the group members may collaborate either having the same duties or undertaking different roles. In any case, one of the group members plays the role of the moderator, being responsible for the coordination of the group process (e.g. proceed to the next question, terminate the communication session), the summarization of the debate and the submission of the final answer.

The ACT tool aims to guide and support the learners appropriately during their debate. To this end, we followed the structured form of the dialogue aiming to (i) eliminate the off-task discussions, (ii) guide the learners towards the underlying learning outcomes of the activity or the duties and responsibilities implied by the model of collaboration, and (iii) enable the automatic interpretation of the learners' interaction as well as the

tracing of the dialogue states. The functionality of the ACT tool in terms of the SST and the facilities provided to the learner as well as the adaptivity of the tool are discussed in the following.

Using ACT

The ACT tool enables learners to communicate and collaborate in the context of a learning activity. The learners have to fill, in the corresponding log in form, their username, the activity index and the sub-activity index. Once all the group members are logged in, the tool enters into the communication mode otherwise the tool enters into the wait mode, showing which members of the group are already connected. Figure 1 presents the main screen of the ACT tool as it appears at the communication mode. It consists of the following areas:

- The *Dialogue Area*, which shows the debate that has taken place. The messages are recorded, numbered and presented in a chronologically sent order. Each dialogue message has the form: [message_number] [sender]: [message composed by the sender].
- The *Message Composition Area*, which enables the learner to construct the desired message on the basis of the SST provided (an analytical description of the message composition process is given in the section entitled "Communicating with ACT").
- The *Message Submission Area*, which enables the learner to submit the message to all or to selected members of the group.

Upon the completion of the collaboration in the context of the activity, the learners may proceed to the elaboration of another subactivity (they can select the desired one through the option "Session/Change Subactivity") or terminate the communication session and exit the tool (i.e. by selecting "Session/Exit" or the button "End Chat" from the Message Submission Area).

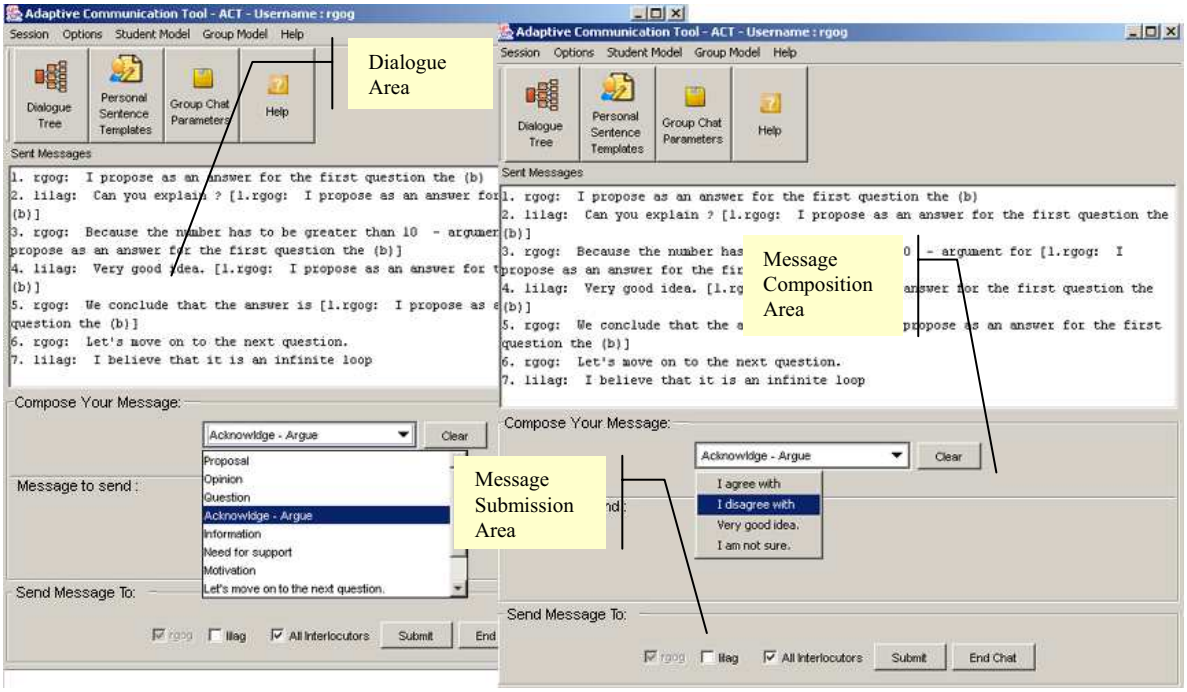

Figure 1: A screen shot of the ACT tool at the communication mode

Predetermined Scaffolding Sentence Templates

In ACT, the structured form of the dialogue is supported utilizing both the sentence openers and the communication acts. For the determination of the most appropriate sets of the scaffolding sentence templates, we followed a research-based approach (Gouli, Gogoulou, Grigoriadou & Samarakou, 2003; Gogoulou, Gouli, Grigoriadou & Samarakou, 2004). More specifically, we conducted three empirical studies during the design phase of the tool in order to determine the appropriate sets of the sentence openers and the communication acts. The supported sets of the SST have resulted from the text-based free dialogues and the feedback received from the participants as well as the experience of the authors. The provided SST are categorized to one or more of the following *discourse categories*: Proposal (P), Question (Q), Reasoning (R), Clarification (C), Motivation (M), Agreement (A), Disagreement (D), Need (N), Opinion (O), and Social Comments (S). The provided sets of the sentence openers as well as the communication acts include:

(i) a subset dedicated to the development of the cognitive skills addressed by the collaborative activity (e.g. the sentence openers: "I propose" , "I agree with"; the communication acts: "Proposal", "Agreement").
(ii) a subset dedicated to the development of communication skills (e.g. the sentence openers: "I don't know. Can you help me?", "Can you explain?"; the communication acts: "Social Comments", "Comments on the Activity"), and
(iii) a subset available only to the moderator of the group concerning cognitive as well as communication skills (e.g. the sentence openers: "We conclude that the answer is", "Let's move on to the next question"; the communication acts "Answer", "Group Coordination").

Communicating with ACT

In the Message Composition Area of the ACT tool, the learner has access to the provided SST and has the possibility to construct the desired message by filling in the required arguments depending on the SST. In particular, regarding the sentence openers, the available SST include:

- [*Sentence*] (fully structured SST): the sentence text as it appears on the list (e.g. "*Very good idea*", "*I don't know. Can you help me?*"),
- [*Sentence Opener*][Argument] (semi-structured SST): the sentence opener plus an argument which may be an explicit reference to an already sent message appearing on the Dialogue Area (e.g. see Figure 1, "*Can you explain?* [1. rgog: …] ", where in […] appears the already sent message by the learner) or may be filled in by the learner (e.g. see Figure 1, "*I propose* as an answer for the first question the (b)").
  In some sentence openers, like "*I agree with*…….", the [Argument] may consist of both a reference message and a filled in text (e.g. "*I agree with* [reference to an already sent message] free text" where the filled in "free text" specifies further the learner's belief),
- [*Sentence Opener*][Argument1][*Conjuction*][Argument2] (semi-structured SST): the [*Sentence Opener*] and the [*Conjuction*] are predetermined sentence texts while [Argument1] and [Argument2] may be an explicit reference to an already sent message appearing on the Dialogue Area or may be filled in by the learner (e.g. see Figure 1, "*Because* the number has to be greater than 10 – *argument for* [1. rgog: I propose as an answer for the first question the (b)]": the first argument has been filled in by the learner while the second one is a reference message),

while regarding the communication acts, the available SST include:

- [*Communication act*][Argument]: the communication act label plus an argument which is filled in by the learner (e.g. "*Proposal*: lets look at the diagram first"),
- [*Communication act*][Reference to a message][Argument]: the communication act label plus a reference to an already sent message appearing on the Dialogue Area plus an argument which is filled in by the learner (e.g. "*Clarification* [15. rgog: What is "st"?]: By "st", I mean the total number of students"); the [Argument] in some communication acts is optional (e.g. "*Agreement* [3. lilag: The answer is (c)]").

In case the [Argument] is a reference message, the learner can select the desired one from a pulldown list appearing next to the corresponding SST in the Message Composition Area.

Besides the predetermined sets of SST, the learner may determine his/her own SST in case the available ones do not cover his/her needs. The learner's determined SST are part of the student's model and become available each time the learner uses the ACT tool. For each additional SST, the learner determines the text to be displayed, the accompanied arguments and the discourse category (e.g. Proposal (P), Question (Q)). At any time, the learner may edit his/her set, through the option "Student Model/Personal Sentence Templates" from the menu or by selecting the button "Personal Sentence Templates" from the toolbar, and proceed to any modifications (e.g. change the text) and/or deletions (i.e. delete one of his/her own defined SST). In this way, the learner has the possibility to personalize the communication/collaboration process and to exceed any potential restrictions imposed by the use of the predetermined sets of SST.

Adapting the Provided Scaffolding Sentence Templates

According to the Activity Theory, the object of the learning activity, the mediational tools used, the rules and the division of labour followed by the learners, constitute essential elements of the conceptual framework (Engeström, 1987; Cole & Engeström, 1993). In ACT, the object of the learning activity is closely related to the expected learning outcomes, the mediational tools involve any tool that may be used during the elaboration of the activity (e.g. educational software), the rules include the provided sets of SST and the division of labour depends on the model of collaboration followed. Taking into account these elements and having as an objective to support the learners' communication/collaboration, to prevent floundering and to guide their thinking towards the desired directions, we adapt the provided SST on the basis of (i) the level of the learning outcomes (i.e. cognitive skills) addressed by the activity, (ii) the specific roles that the learners undertake in the context of a specific model of collaboration, and (iii) the educational tool, if any, used for the elaboration of the activity.

On the basis of the proposed adaptation framework, the sentence openers are aligned with the Comprehension, Application and Checking-Critiquing level of the cognitive skills, while the communication acts are aligned with the Creation level and the role that each learner undertake. Also, the communication acts are used to support the learners' dialogue in case learning activities do not explicitly address one out of the four aforementioned levels of cognitive skills, but they rather aim to cultivate to the learners skills in communication, and/or to enable them to discuss/exchange ideas on a specific topic or on the subject/solution of an activity. We support the sentence openers for the Comprehension, Application and Checking-Critiquing level of cognitive skills as these are more concrete. The communication acts are considered more appropriate for higher order cognitive skills or when a model of collaboration with roles is followed since it suffices to guide/assess the learners in terms of their intention/action. We verified and finalized the above design principles of the adaptation framework by the results of the three empirical studies we conducted (Gouli, Gogoulou, Grigoriadou & Samarakou, 2003; Gogoulou, Gouli, Grigoriadou & Samarakou, 2004).

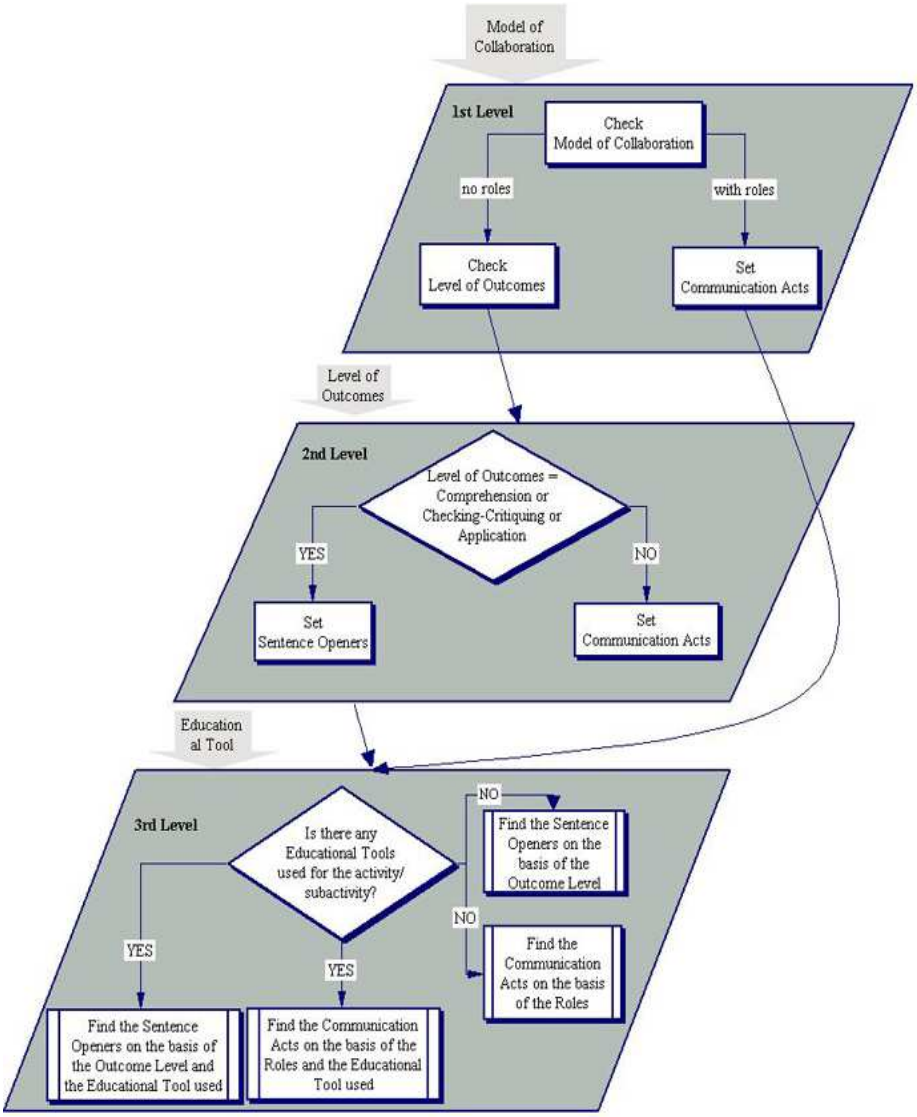

Figure 2. The three-level process of the adaptation framework

The adaptation framework follows a three-level approach depicted in Figure 2:

- 1st Level: At the 1st level, the adaptation mechanism checks if the group members are going to undertake specific roles during the elaboration of the activity/subactivity or to collaborate having the same duties. In the first case, the communication acts are used while in the second case the adaptation mechanism proceeds to the 2nd level in order to check the level of the learning outcomes.

- 2nd Level: This level takes as input and checks the level of the learning outcomes. In case the level coincides with one of the Comprehension, Checking-Critiquing or Application levels, then the dialogue is carried out with sentence openers otherwise with communication acts.
- 3rd Level: Once the provision of sentence openers and communication acts has been specified, the appropriate sets need to be selected. In case of sentence openers, the set of the SST dedicated to the development of cognitive skills depends on the level of the learning outcomes (e.g. the set of the SST for the Comprehension level is different from the one provided for the Checking-Critiquing level). In case of communication acts, when a model of collaboration with roles is followed, the provided SST are adapted to each member according to the underlying role. An additional factor, which influences the set of the provided SST is the educational tool used (e.g. for a concept mapping tool, sentence openers like "I propose to link [concept] to [concept]", "Do you agree with the proposition [concept-link-concept]?" are available).

From the above, it becomes obvious that all the group members (except from the moderator of the group, who has at his/her disposal additional SST compatible to his/her additional duties) have at their disposal the same set of SST if they collaborate having the same duties. For example, in case the activity addresses learning outcomes of the Comprehension level, then all the members of the group may use sentence openers like "I propose", "I believe", "I agree" while in case the activity addresses learning outcomes of the Checking-Critiquing level, then all the members of the group have at their disposal sentence openers like "I propose … because …", "I believe … because …", "I agree … because" urging them to justify their point of view. In case a model of collaboration with roles is followed, the provided SST are different for the group members supporting their roles appropriately. For example, in Figure 3, the two learners with user names "rgog" and "lilag" collaborate according to the "Driver-Observer" model: the "driver" (learner "lilag") is responsible for making proposals, answering to the "observer's" questions, and implementing the task while the "observer" (learner "rgog") is responsible for making comments, asking questions for clarifications, expressing her opinion, giving the answer and guiding the elaboration of the activity. The provided SST are different for the two learners (e.g. "Proposal", "Clarification-Explanation", "Justification" for the "driver" "lilag" and "Question", "Opinion" for the "observer" "rgog").

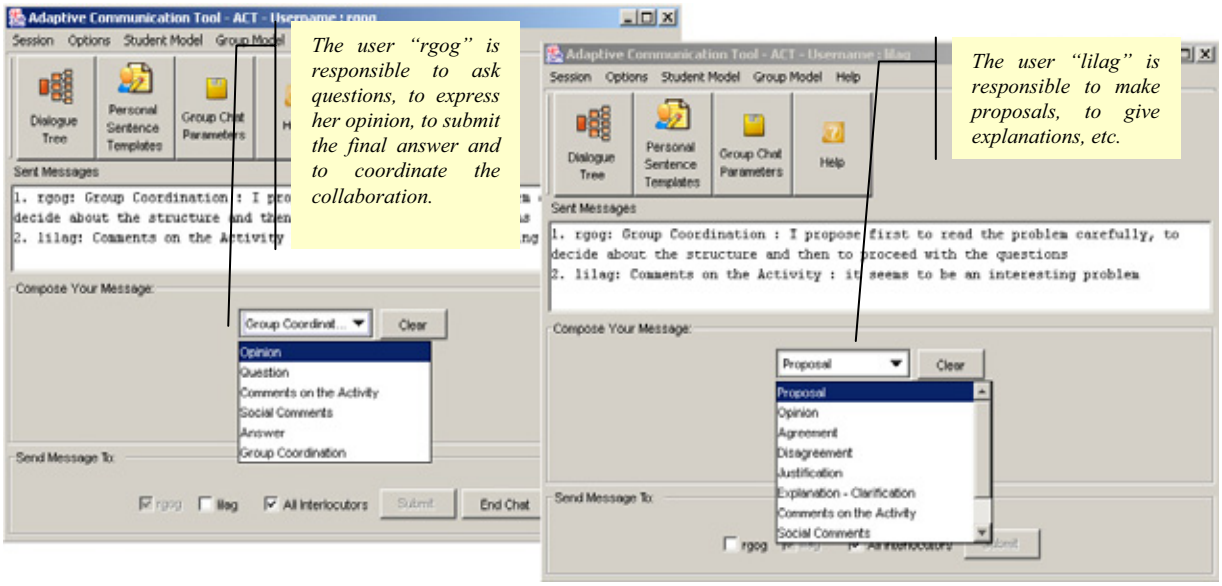

Figure 3. Adaptation of the communication acts according to the roles implied by the collaboration model

Monitoring the Dialogue

In assessing learners' interaction and subsequently their collaboration, the CSCL environments offer mechanisms to automatically trace learners' actions and/or their dialogue. Usually, the data are recorded into log files and may be further analyzed in terms of high-level indicators. According to Jerman, Soller and Mühlenbrock (2001), the CSCL environments may gather data about the learners' interaction and show this information to the learners in a visualization form or process the data and coach/guide their interaction.

In ACT, the learners' interaction is recorded into log files, which are accessible, by the tutor. Moreover, since we are interested in assessing the learners' communication in terms of the skills addressed by the collaborative activity or the collaboration model, we keep records of the learners' messages as these are classified to the aforementioned discourse categories (i.e. Proposal (P), Question (Q), Reasoning (R), Clarification (C), Motivation (M), Agreement (A), Disagreement (D), Need (N), Opinion (O), and Social

Comments (S)) and proceed to their quantitative analysis. The data resulted from the analysis are accessible both to the learners and the tutor and concern the number of messages sent by each group member for each one of the discourse categories (e.g. number of Proposals), the groups that have performed the specific activity/subactivity, the models of collaboration followed in the context of the specific activity/subactivity, etc. The learners can have access to these data at any time during their communication through the option "Group Model".

As the learners' communication is carried out, their messages are visually represented in a tree structure, grouped according to the reference message. In particular, ACT supports a facility for the automatic construction and update of the Dialogue Tree as the learners submit their messages. The messages are grouped into sub-trees according to the message that they are referring to. The learners can have access to the Dialogue Tree at any time during the communication through the option "Options/Dialogue Tree" or through the button "Dialogue Tree" from the toolbar. The main advantage of such a graphical representation of the dialogue is that the learners can see the dialogue in a different form, can trace the sequence of the dialogue more easily and can have a clear view of the dialogue progress. Also, the Dialogue Tree can stimulate the learners to reflect on their dialogue and improve their participation. In Figure 4, a screen shot of a dialogue tree is presented.

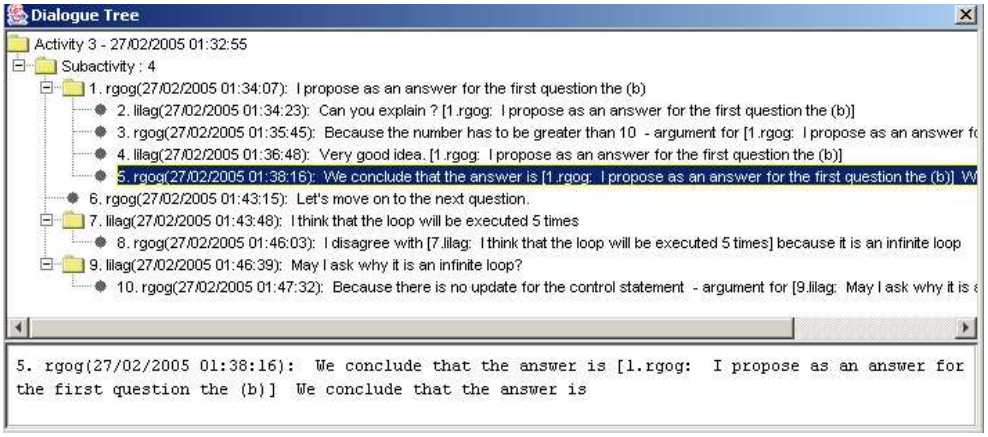

Figure 4. The Dialogue Tree represents the learners' debate in a graphical form

EVALUATING ACT

During the formative evaluation of the ACT tool, an empirical study was conducted. The aim of the study was two fold: (a) to investigate whether (i) the predetermined set of the SST cover the learners needs in terms of their completeness, understandability, accessibility and facilitation of the dialogue, (ii) the adaptation framework is appropriate and complies to the learners' communication preferences, and (iii) the provided facilities (Dialogue Tree and enrichment of the SST) serve their aim, and (b) to analyze the learners' dialogue in terms of investigating the proper use of the provided SST, the coherence of the dialogue and the degree of the learners' participation.

The empirical study took place during the spring-semester of the academic year 2003-2004 in the context of the postgraduate course of "Distance Education and Learning" at the Department of Informatics and Telecommunications of the University of Athens. Thirty students participated in the study, coming from a range of backgrounds and having different expertise in the use of communication media. The duration of the study was 4 hours; each student worked on his/her own computer. We grouped participants into two-person (9 groups) and three-person (4 groups) teams; one of the members undertook the role of the moderator.

The working sheet included (a) a brief description of the ACT tool, (b) a description concerning the form of the dialogue followed and the SST provided, (c) four collaborative learning activities, and (d) a questionnaire concerning the facilities provided. Upon the completion of each learning activity, the students were asked to answer a series of questions (multiple choice and open questions) concerning the usability of the tool, the communication process, the role of the moderator, any problems identified, etc. For the first three activities, the students of each team had the same duties and acted equivalently while in the context of the fourth activity, specific models of collaboration were followed, i.e. the "Questioner-Responder" model for the two-person teams and the "Questioner-Responder-Assessor" model for the three-person teams. The first activity asks the students to follow a specific scenario enabling them to explore the facilities of the tool and become familiar with the form of the provided SST. The second learning activity addresses cognitive skills, which concern the students' ability to remember and understand things (Comprehension level) and therefore sentence openers were used. The third activity urges the students to think of/reason/discuss/exchange ideas on a specific topic using communication acts. Finally, the fourth activity addresses cognitive skills, which concern the students' ability to check the correctness and the completeness of a given "product", to reason about their opinion and to proceed with any

necessary modifications of the "product" (Checking-Critiquing level and Application level). According to the adaptation framework, communication acts were used in the fourth activity as the models of collaboration implied specific roles.

Empirical Results

The empirical results, concerning the first aim of the study, were drawn from the analysis of the students' responses on the questions accompanied each collaborative learning activity and the questionnaire included in the working sheet. The analysis of the students' answers concerning the provided sets of the SST is depicted in Figure 5. More specifically,

- the majority of the students characterized the completeness of the predetermined sets of SST as sufficient and rather sufficient (90% for sentence openers and 87% for communication acts).
- a considerable number of students characterized the way the SST are presented and especially the localization process of the desired SST, as easy (sufficient and rather sufficient). However, 25% of the students found difficulties to localize the appropriate sentence opener to be used (characterized the specific criterion as average and rather insufficient). They considered that the provided SST could be grouped instead of presenting them in a list. This result was taken into consideration and we redesigned the form that the SST are provided to the learners (a group formation of SST is supported; see Figure 1).
- most of the students (70% for sentence openers and 94% for communication acts) believed that the use of the provided SST facilitated their dialogue (characterized the specific criterion as sufficient and rather sufficient). Although a small percentage (6%) of the students believed that the provided set of communication acts made the communication process difficult, the corresponding percentage for the set of sentence openers was quite high (30%). The students' answers indicate that the size, the form and the number of arguments of the sentence openers may cause difficulties; on the contrary, the set of the communication acts is smaller and the form as well as the number of arguments to be filled in is simpler than in the case of the sentence openers. It is important to mention that most of the students, who found difficult the use of sentence openers, have high degree of expertise in the use of chat tools and prefer the free dialogue.

As far as the application of the adaptation framework is concerned, the majority of the students (approximately 80%) considered the provision of the sentence openers or the communication acts in line with the context of the activities. A percentage of students (approximately 10%) argued that the communication acts (sentence openers) could also serve the underlying outcomes of the second (third and forth) activity and some of the students (10%) preferred the sentence openers (communication acts) instead of the provided communication acts (sentence openers).

Regarding the facilities provided to the students, the analysis of the students' answers showed that

- a considerable number of students (76%) found the facility of connecting a message with an already sent message very useful since it reduces the typing load. However, 24% of the students characterized the specific facility as indifferent because they believe that the complexity of the composition message process is increased.
- the majority of the students (83%) considered the capability of the ACT tool to group messages into sub-tress and to represent the dialogue in a visual graphical form (Dialogue Tree) very useful because it enables them to monitor the dialogue in an organized and enjoyable manner, to evaluate the collaboration process more easily and to proceed to interventions in order to improve their participation. However, a number of students (17%) mentioned that there was no need to consult the Dialogue Tree.
- most of the students (66%) characterized the facility of enriching the predetermined sets of sentence openers and communication acts with their own phrases useful. Approximately, 50% of them took advantage of the specific facility during the elaboration of the activities, defining one or two phrases.

The analysis of the students' dialogues (log files and dialogue trees) revealed the following:

- The majority of the exchanged messages indicate that the provided SST were used in correct manner. It seems that the students understood the underlying intention and they selected carefully the most appropriate SST. In one case, one of the group members was quite eager to participate and was inclined to conclude the main points of the discussion, although he was not assigned the role of the moderator (since he didn't have at his disposal such a phrase, he made use of the possibility to define his own phrase).
- The dialogues presented sequential coherence as the students listened carefully to their interlocutors and related their answers to the appropriate message. In some cases, the depth of the dialogue trees was five levels deep showing that the students were able to agree/disagree, justify their opinions and follow up the others' contributions. To this direction, the provided facility of connecting a message with an already sent message helped quite a lot. However, there were a very few cases that the dialogue seemed to be quite flat as one of the group members didn't not contribute in time while the rest two members continued the discussion.

- All the members of each group participated actively in the discussion. The students appreciated their interlocutors' opinions (e.g. they used the phrase "Very good idea") and they perceived the need as well as they were motivated by their interlocutors' questions to elaborate on their opinions.

Although the above results are preliminary, the provided SST as well as their usage and accessibility seem to be satisfactory and they caused minor difficulties resulting into coherent dialogues. Also, the adaptation mechanism proved to be appropriate regarding the selected set of the SST and the facility of enriching the predetermined sets of SST with the learner's ones, gives a degree of freedom to the learners. The visual representation of the Dialogue Tree supports the monitoring of the dialogue and the students claim that serves as a means to reflect on the collaboration process.

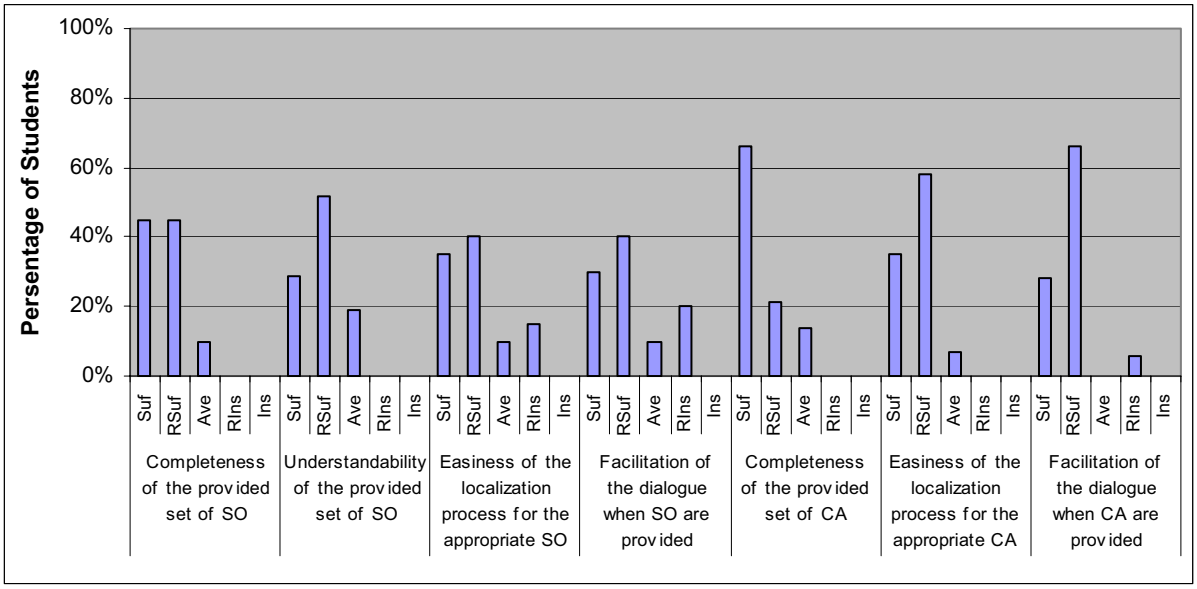

Figure 5. Results concerning the provided set of sentence openers (SO) and communication acts (CA). The abbreviation Suf stands for Sufficient, RSuf for Rather Sufficient, Ave for Average, RIns for Rather Insufficient and Ins for Insufficient

CONCLUSIONS AND FUTURE PLANS

In this paper, we presented ACT, a synchronous communication tool enriched with adaptive capabilities. The discriminative characteristics of the ACT tool are: (i) the use of both sentence openers and communication acts for the implementation of the structured dialogue, (ii) the adaptation of the provided sets of the SST according to the learning outcomes addressed by the collaborative learning activity, the model of collaboration followed by the group members, as well as the educational tool used for the elaboration of the activity, (iii) the capability of alleviating the possible restriction of the learners, imposed by the structured form of the dialogue, by enabling learners to define their own SST and enrich the provided sets, and (iv) the monitoring of the group dialogue and its graphical representation through the Dialogue Tree. The provided facility of connecting/grouping messages by making explicit reference to a previous message as well as the capability of defining SST enhances the contextual structure of the exchanged messages and enables the learners to follow the communication forms that match as much as possible their own preferences and needs. Our near future plans include the enhancement of the adaptive and adaptable capabilities of the tool with respect to the learners' preferences and interaction behavior (e.g. support of the free dialog after a negotiation of the group members) and the enrichment of the monitoring facilities with additional features regarding the visualization of various quantitative collaboration indicators, such as the density of interaction and the degree of collaboration.

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