COFFEE: a software to blend face-to-face and written communication in collaborative problem solving-based scenarios

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Introduction

Current research in Computer Supported Collaborative Learning (CSCL) (Kienle & Wessner, 2006) and knowledge building (Scardamalia & Bereiter, 2006) produced many classifications of educational settings where collaboration takes place. Many types of software have been investigated as well as different educational settings. For instance, Russell et al. (2002) investigate the effects on collaboration around large interactive displays. Shen (2003) shows how the use of an interactive surface, a table-top display, helps on sharing documents. Nevertheless, different studies have claimed that, at least in European educational systems, the most part of didactic activities are still carried out within face-to-face settings (Collis and Van der Wende, 2002; Ruthven *et al.*, 2004).

The most part of software, even when supporting face–to-face (F2F) collaboration, are designed around written communication. For instance, *Omega+* is an environment built around a chat provided by functionalities such as multiple rooms and private channels (Lonchamp, 2006). To these features, *Omega+* adds four modules customizable by the users. Nevertheless *Omega+* lacks integration and expansion of the four modules.

Another text-based interesting software is *Drew* (Dialogical Reasoning Educational Web tool) (Baker, Quignard, Lund & Séjourné, 2003). *Drew* provides a set of tools supporting collective argumentation, such as argument-graph and chat tools.

Some piece of software also explicitly conceive the computer mediated communication as a lever to sustain and improve F2F communication, such as *Knowledge Forum* (Scardamalia, 2004), *FLE3,* and *Synergeia* (Ligorio & Veermans, 2005; Muukkonen, Lakkala & Hakkarainen, 2001).

All these pieces of software are meant to be very flexible and they support any type of task. Instead COFFEE, a software designed within an European project called LEAD (www.lead2learning.org), is specifically devoted to collaborative problem solving tasks and it is aimed at carefully blend F2F and written communication. The reasons we think this is important are the following:

a) Collaborative problem-solving is a complex educational strategy, able to encompass many other strategies. Planning and organizing such strategies forces the classroom to revise the whole educational setting. To accomplish such a goal, pedagogical scenarios need to be designed. Later we will explain what we mean by pedagogical scenarios;
b) To blend F2F and written communication a multi-channel tool should be available. Such a tool should trigger many types of reasoning, cognitive and meta-cognitive communication, and diverse degrees of social sharing. When these skills are combined in an appropriate way and insert into a well designed pedagogical scenario, than deeper knowledge building can be afforded.

Pedagogical scenarios based on collaborative Problem-solving

Collaborative problem solving tasks require a wide range of skills and expertises on the side of the learners. They have to organise and share their conceptual understanding of the problem; they need to explore different directions, search for relevant information, provide arguments, manage roles and social interactions, contribute with ideas and hypothesis, and finally reach a shared conclusion. COFFEE is meant to support and organize all these aspects. In particular, COFFEE should enhance a wide range of pedagogical scenarios, meant to be adequate for students from 10 to 18 years old as well as for university students and for professionals.

The specific model of collaborative problem solving to which we refer is described by Baker (2002). Following that model, activities can be structured in a few steps, conceived as sequential in time. Each of them can be composed by several activities, such as group discussion, brainstorming, collaborative writing, jigsaw, reciprocal teaching. In this sense, a pedagogical scenario is considered as a general framework where many educational activities can be included.

In the following we present an example of pedagogical scenario composed by four steps. For each step a few activities are suggested. Teachers and students can select steps and activities according to their needs and contextual plans. The number of steps, the number and type of activities has to be considered as just a suggestion: steps and activities can be skipped or new steps and activities can be added; also steps and activities once selected can be changed and modified.

Steps	**Aim**	**Possible activities**
First Step	Definition of the problem	-Collective brainstorm guided by questions like “What is the problem we want to inquiry about?”

		- Classroom discussion guided by questions, like “Why is this problem relevant?”
Second Step	Gathering information	- Jigsaw - Small group discussion - Traditional lesson - Benchmark lesson
Third Step	Definition and evaluation of the hypotheses	- Discussion guided by research questions - Establish and manage a socio-cognitive conflict - Laboratory activity - Role play
Fourth step	- Solution - Producing a final collective product	- produce a poster, - an hypertext, - a collective text - a description of the “case”

Table 1. A set of steps and activities suggested for problem solving based pedagogical scenarios

In the following we will first describe synthetically the software COFFEE and later it will be provided an example of how a pedagogical scenario based on collaborative problem-solving can be enhanced by COFFEE.

COFFEE at a glance

COFFEE is a suite of Eclipse RCP-based applications (www.eclipse.org/ecf/ ; www.eclipse.org.) containing: the Roster Editor, the Session Designer, the Session Player and the Session Client. The Session Player is launched by the teacher, whereas the Session Clients are applications dedicated to the students. The teacher organizes a session by using the Session Designer and by selecting a session template from a set of pre-assembled template sessions. Then the session is played at run-time by the server (Session Player) that allows choosing also the authentication mode (no nickname, or nickname/password as specified in the roster of the class). The testing was made with COFFEE’s 0.10 temporary version, where only a few tools were available: a presence tool, a public treaded chat and a private note space[1].

[1] At the end of May 2007 the Alpha version of COFFEE 1.0 has been released, including main features, such as enhanced presence and group management tools, a threaded chat tool, a graphical shared workspace, etc.

In-house testing

A first test with COFFEE was run by having researchers playing the role of students. Researchers were collapsed into two groups. The participants were in total 8 researchers, balanced by gender. One group was composed by computer scientists that already knew COFFE, while the other group was composed by researchers on the field of education. One senior research played the role of the teacher. The scenario was specially designed to observe the following dimensions:

- the general effect of the tools on the discussion
- the intra and inter-group interactions
- the relationship between F2F and computer mediated communication.

This test had also the objective to reflect upon the role COFFE could play on better define a problem-solving based scenario.

The whole session lasted about 1 hour and it was entirely video-recorded. The XML digital traces of the interaction were also recorded. The session was structured as an argumentative discussion to be carried out in three steps. Both small groups' discussion within the two groups and a classroom discussion took place (Baker, 2002). The given task was to discuss about a classical dilemma of cognitive science: Is the computer a suitable model of human mind? (Putnam, 1991).

Each group had to defend a position: the first group (computer scientists) had to argue against the hypothesis of computers as good models of human mind; the second group (educational scientists) had to defend the opposite position.

The pedagogical scenario used

The pretending-to-be-a- teacher senior researcher (the teacher from now on) briefly welcomes participants, introduces the session, describes the software and the tools that will be used. The teacher presents the task and the sequence steps. The pedagogical scenario defined for this test was the following.

Step 1 - Working in small groups: each group discusses to elaborate a list of arguments that will be used later during a classroom discussion. This step lasts about 15 minutes. The threaded chat and private space tools will be used.

Step 2 - Classroom discussion: the two groups join together and discuss by using the arguments previously elaborated to defend their positions. This step also lasts about 15 minutes and again the threaded chat and the private space tools will be used.

Step 3 - Collaborative writing: groups are separated again and each of them has to write a group report about the discussion, including also the arguments from the other group. Conclusions should be stated, if any. 20 minutes are allocated for this step. Text editor and simple chat tools are available.

At the end of the session a group discussion was conducted to gather feelings and comments on the whole testing.

Data analysis

Three types of data were collected: videos, field notes taken by two observers, and digital traces of the computer mediated interaction. The computer traces were synchronized with the video-recording of the F2F interaction. Later, relevant episodes were captured and the appropriate field notes were attached to them. Finally, the episodes were transcribed. In this way, the analysis performed could take in account simultaneously three types of data: videos, verbal interactions and textual interactions (Spagnolli et al., 2003).

To understand the general effect of COFFEE we looked at the number of the written messages exchanged at each step of the pedagogical scenario.

Results

To test the effect of using COFFEE the number of messages produced by each group at each step was compared. It was found that the number of messages produced by the group composed by educational researchers was quite stable all along the three steps (Figure 1). For the other group (computer scientists) the number of messages produced increased at the second step (inter-group discussion) and decreased during the last step. For both groups the inter-group activity (step 2) provoked more communication.

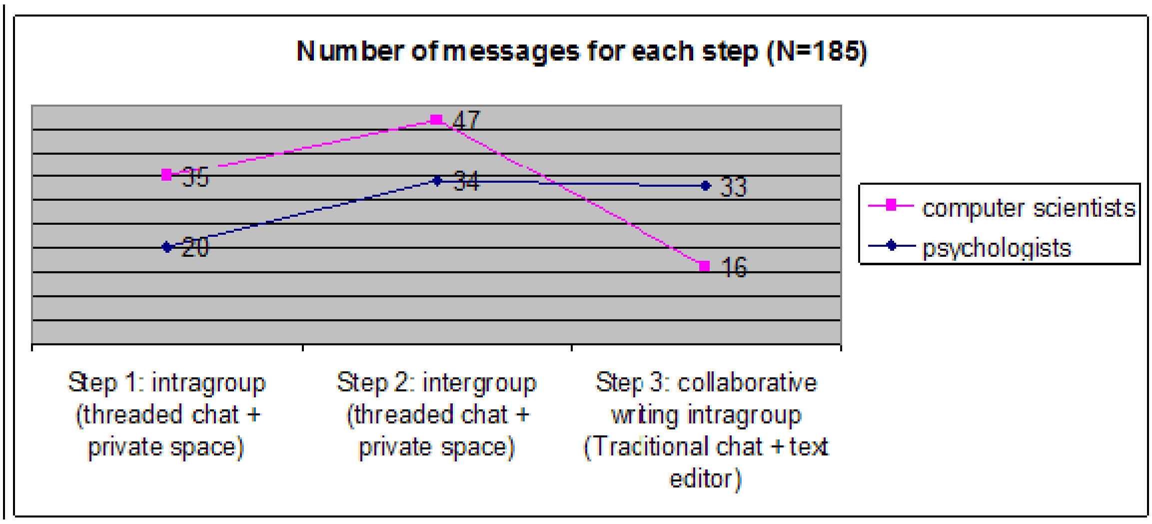

Figure 1. The number of messages exchanged during each step.

One possible reason of such result is that computer scientists already knew how to use COFFEE, while the other group did not. In particular, educational scientist talked less F2F because they felt the presence of the software forced them to write. This is what they declared during the final discussion. The greater difficulty they experienced was on managing simultaneously F2F and computer mediated discussion. One example of how complex this was to be managed is described into the following excerpt from step 2, which was the most productive one. The excerpt is reported in table 2 where audio, video and the text contained into the threaded chat are synchronised. Names of the participants are accompanied by CS when they belong to the computer scientists group, and by E when they belong to the educational group.

Audio	**Video**	**Threaded Chat**
		Fulvio (CS): Can you elaborate this argument? Tony (CS): basically we underlined the limits of computers with respect to imagination and possibility of gathering experiences Giusy (E): no way guys, the level of perfection a computer can reach in processing information cannot be discussed. The mind operates always a certain degree of distortion (see the subjectivity in perceiving things)
Tony (CS): subjectivity in perceiving things (0.1) If you start talking like an expert (0.5) we don't	Tony (CS) reads aloud the last part of Giusy's (E) sentence. All his neighbors are laughing	Giorgio (CS): I claim that imagination is an aspect computers would never have. Imagination is everything in scientific research.

communicate any more *((the whole group laughs))*		
((Giusy (E) laughs)) Giusy (E): Tony, we don't communicate anymore *(Molly (E) laughs))* Giusy (E): *(((to Tony))* so let's say a little bit more (0.5) things	 Giusy (E) looks at Tony (CS)	
Molly (E): (( ) *((smiles))*	 Molly (E) looks at Giusy (E) and starts typing a new topic in the chat-box	Molly (E): computers not only elaborate info just like mind does, but also removes mistakes

Table 2. An excerpt from step 2.

Tony, a computer scientist, raises a question about an utterance written by Giusy (from the educational group). When Giusy reads Tony's reply, she turns toward the group of the computer scientists, and talks to them, while the chat discussions stops. Molly, a Giusy team-mate, stops writing and looks at the other people smiling. Molly chooses to stop typing and she sustains Giusy in giving more relevance to the F2F discussion and pushing the written discussion in the background. The reason to do that is that the discussion going on at the moment could be ambiguous. Tony is giving a remark on Giusy's sentence that assesses her position as too scientific. Giusy could be mistaken as a snob discussant and Tony is threatening to stop the conversation. At the same time he is laughing together with his group. Giusy decided to use the non-verbal code (she turns in their direction) and to talk to them with the intention to set the discussion on a joke level. Molly is spontaneously supporting her on this: she looks in the same direction Giusy is looking at she smiles, and she stops writing as well.

We see in this episode that multi-channel communication is not easy to be handled. Users may not always be able neither to select the right channel nor to combine the most appropriate. The type of analysis we performed is aimed at looking in depth into the management of such complexity and to gather suggestions for the COFFEE architecture.

Conclusions

The testing here presented represents just an explorative study. Finer analysis of the data collected is still needed and testing with more users into real classrooms started to be performed. Nevertheless, we believe some useful hints can be gathered by this study. First of all we learnt pedagogical scenarios need to be carefully designed. The number of steps, the activities designed and their sequence seem to have a positive impact on the performance; in fact during the final discussion the participants reported that they felt the first small-group activity feed the large group discussion and the large group discussion was very useful for the small-group activity undertaken afterward. We may infer that alternating small-group activities with activities to be performed by collapsing all the groups is a good guide-line to design pedagogical scenarios.

Furthermore, the level of familiarity with the software impacts the general intensity of communication. Therefore, a warm-up session should be always included as preliminary activity into the pedagogical scenario.

Finally, we argue that blending F2F with computer mediated communication needs to be well organized and the software should include some “tricks” expressly designed for this goal. For instance, users should be able to “freeze” the software in order to stop all the writing; or the threaded chat could have some “awareness” disposals, such as showing in bold the unread messages or alerting the user when a new message has been entered. In other words, knowledge building occurring when F2F and written communication is combined needs to be supported by both technical features implemented into the software and by a well thought pedagogical scenario. Any how, the intensity with which the two groups worked on the task comforted us that COFFEE is developed along the right direction.

Future direction of our research concerns the definition of templates of pedagogical scenarios composed by steps and activities suitable for collaborative problem solving tasks, differentiated by students’ age and by disciplinary content. Teachers should be able to select and customize the available pedagogical scenarios and as well as the tools available into COFFEE (such as the threaded chat and the private space), according to a few dimensions such as number of groups into which the classroom can be divided, the time allocated to the task, and the degree of experience gained with COFFEE.

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