T. Koschmann, D. Suthers, & T.W. Chan (Eds.), *Computer Supported Collaborative Learning 2005: The Next 10 Years!*

Improving the Coordination of Collaborative Learning with Process Models

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Abstract. CSCL is seen as a socio-technical process which has to be carefully planned by both students and teachers. These processes can be presented as graphical models which serve as maps to guide the students through their collaboration. In an experimental field study, the participatory development of these models was compared to a condition without models. The data shows the advantages of graphical models for the students' planning coordination. Most of the five hypotheses are confirmed in this study. These findings show just how important a technical concept is which helps to integrate the developed models as a means of coordination and navigation into CSCL-systems.

Keywords: Coordination, graphical process models, maps, representational guidance

INTRODUCTION: THE NEED TO SUPPORT STUDENTS' COORDINATION

It is an increasingly common finding in CSCL and CSCW studies that CSCL is a socio-technical process which requires careful planning and preparation by both students and teachers. In several experiments with CSCL for seminars conducted at a university, we learnt that the effort needed to be put into this preparation is often underestimated. Our approach was to offer the students a platform with which they could coordinate and mutually prepare presentations. We pursued a concept of blended learning where students present the results of their research in face-to-face sessions, while the research itself is organized as teamwork. The teams of three students used a web-based system to collaborate. We tried to initiate learning processes by deliberately designing tasks which were able to motivate the students in collaborating and sharing their results. They were asked to integrate their differing findings and perspectives and produce a single document. We have worked with platforms such as BSCW (Appelt & Mambrey, 1999), LiveLink™ (Opentext) and KOLUMBUS (Kienle & Herrmann, 2003) which can be used to exchange documents, web-links, comments etc. In our first experiments we focused on giving the students instructions as to how they could interact with the system and then expected them to develop their own way of collaboration. However, we learnt that this kind of preparation was insufficient and that our expectations were not fulfilled.

We could observe a number of problems which arose in this kind of setting that had similarly also been found by other authors (Guzdial & Turns, 2000, Lipponen et al., 2002):

- The interaction between students and the sharing of knowledge was poor. They split the task into independent parts instead of collaboratively working on it. Statements, questions, comments etc. from different students were not really interrelated or presented in integrated documents. Thus, there was a poor convergence of the students' perspectives (Stahl & Herrmann, 1999).
- The students did not use the system as intensively as was expected. Many of the system's possibilities remained unused.
- The use of the systems didn't really improve the teams performance.
- The expectation that the students would be able to organize their collaboration themselves while using the system was not fulfilled.

Our explorative studies showed that those aspects of the learners' tasks which refer to the process of computer-mediated collaboration were often neglected. We could say that the more the learners focused on the content of their task, the more they lost their awareness of the process of collaboration and the possibilities that the technical system offered. We came to the conclusion that we can not study the effect of computer support on collaborative learning before we have a method that ensures that intensive collaboration and usage of the system takes place. We can therefore see that supporting the students to plan their process of collaboration on their own will be a major success factor. This is based on the assumption, that CSCL not only covers content-oriented learning but also process-oriented learning. Fig. 1 shows the different stages of preparation for CSCL.

The rectangle shows the main focus of research in this paper. The focal point implies that the students learn how to organize collaboration, and that they gain a meta-cognitive understanding of what they will be learning, and how they will be learning it. It also includes an increased awareness of the collaboration process and of what problems could arise.

While the definition of the task and its presentation can mainly be carried out by teachers, the plan of the collaboration process has to be developed by the students themselves as opposed to being delivered to them. This is due to supporting self-directed learning and learning "how to learn collaboratively". The planning of the collaboration and of the usage of the system should take place in face-to-face sessions before the system is used. The outcome of the planning phase can be a graphical process model which guides the further process of collaboration.

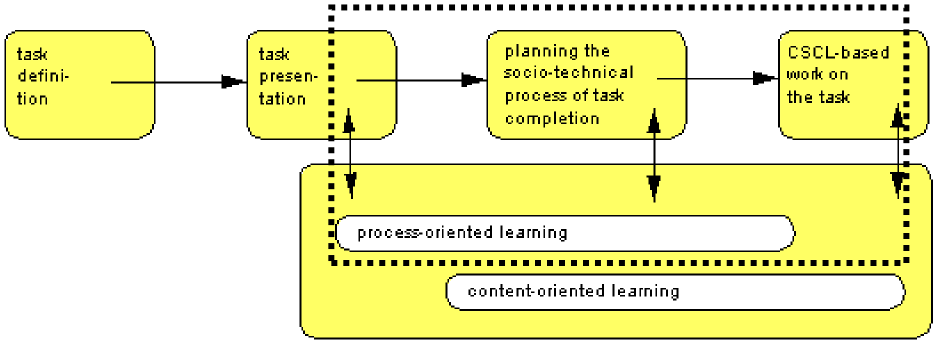

Figure 1: The focus on process-oriented learning

The effects and the appropriateness of this kind of process model in supporting a smooth collaboration can be compared with other concepts (cf. section "Related Work"). This comparison as well as our explorative CSCL-studies led us to the proposal that students should develop graphical process diagrams as maps which guide them through the technically supported collaboration.

This proposal is based on our research during the last seven years when we explored the role of graphical models in supporting collaboration in work and learning. For this purpose, we have developed an appropriate modeling notification, an editor which supports it, and "the socio-technical walkthrough" as a participatory method in applying these tools. Now we have the basis to systematically investigate the possible effectiveness of model building as a preparatory stage in CSCL curricula. In this paper we start with a field experiment which provided statistical evidence of the strengths of process maps and the socio-technical walkthrough by contrasting them with text based instructions (sections "Method" and "Results"). This finding justifies further elaboration of a technical concept which integrates process models as maps for collaboration into the CSCL-system itself (section "Conclusion"). Future tests will show how the improved planning has an impact on the collaborative process, the task accomplishment and the learning.

RELATED WORK: PROMOTING THE COORDINATION OF COLLABORATIVE LEARNING

In CSCL research, four main concepts of supporting group coordination and collaborative learning are discussed. These are: *cooperation scripts* (Dillenbourg, 2002), *maps* (Wang et al. 2000), *scaffolding* (e.g. Weinberger al., 2002, 2004), and *feedback* as a strategy of coordinated intervention (Zumbach and Reimann, 2003). In this article, we focus on the difference between scripts and maps and their potentials for guiding groups through the process of planning and carrying out their computer supported collaborative learning process. These concepts are closest related to process modelling as we have analyzed them in this paper.

Following Dillenbourg (2002, 64), a *collaboration script* can be described as "a set of instructions prescribing how students should form groups, how they should interact and collaborate, and how they should solve the problem." Numerous approaches can be summarized under the term cooperation script. With respect to speech act theory (Austin, 1955), some solutions implement posting of categories in the learning environment to promote the knowledge building group interaction. For instance, Baker and Lund (1997) use a structured communication interface containing a set of communication act buttons ("I agree", I propose to…", "Do you agree?") in order to facilitate an easier understanding. The buttons are grouped in categories according to their communication function (e.g., "construct a knowledge chain", "come to agreement", "manage the interaction"). Ludvigsen and Mørch (2003) used different categories of inquiry (e.g., problem, deepening knowledge, reliable knowledge, meta-comment) which are seen as relevant for scientific inquiry but also helpful as problem solving guidelines. In their approach, students had to select a category of inquiry each time they posted a message.

Generally most of these script approaches are more or less related to supporting content related group discussion but are not designed to promote the learning *process* itself. Therefore, Weinberger et al. (2002, 2004) suggested a differentiation between content related (epistemic scripts) and cooperation related scripts (social scripts) to enhance the learning of the process of problem based learning. In their approach, the former were based on content related questions or on a cloze which has to be answered or filled in and thereby leads the students through the learning material. The latter assigned the student two different roles, viz *analyzer*, who has to analyze the material accurately, and *reviewer*, who has to prove the arguments of the analyzer and find both inconsistencies and gaps in the argumentation. Their results showed that social scripts can enhance individual acquisition of knowledge, whereas epistemic scripts apparently do not to lead to expected outcomes. Indeed, there is not yet an evidence that social scripts are suitable for learning and internalizing *the process* of collaborative learning in such a way that learners are able to transfer this process to other learning situations in a self-directed way.. Another script related approach focussing on the process perspective of collaborative learning is the learnflow system designed by Wessner et al. (1999). They designed a process orientated script by predefining sequences of actions which are built into the learning system like a learnflow. However, this learnflow approach neglects the articulation work, collaborative learning needs to make the "flow" happen (Schmidt and Bannon, 1992). Resumptive scripts are rather restrictive, implemented in the CSCL-system, prepared by the teacher and only allowing only one predefined solution of how the learning process should be carried out. However, particularly in problem solving situations there is usually more than one way of performing the collaborative learning process. Therefore, these script implementations are hardly suitable in supporting students to plan and carry out their collaborative learning process in a self-directed manner.

In contrast to scripts, our conclusion from the literature is that maps (as a form of graphical process models) are more suitable in supporting the collaborative learning process because they are "inherently vague" (Suchman, 1987). Following Schmidt and Bannon (1992, 25) it can be said that "any non-trivial collective activity requires effective communication that allows both ambiguity and clarity". On the one hand, maps presuppose a plan of the required activities, the agreements about who is doing what with whom, and the resources needed, but they do not represent these practices and circumstances in full detail. With all respect to promoting self-directed learning and the building of a mutual understanding of the learning process, maps could be developed at the beginning of the learning process jointly by the students rather than being provided by the teacher.

Wang et al. (2000) designed a map orientated approach "supporting teams in the description and definition of processes, the learning of these processes, and the adaption and execution of these processes" (p. 358). A directed graph underlies their hypermedia based approach. The nodes represent tasks and the edges represent the coordination structure between the tasks. Wang et al. (2000) provide a shared hypermedia workspace in which users can access shared and persistent objects (nodes and links). Tasks (nodes) and the connections between tasks (edges) can be manipulated either synchronously or asynchronously by the students. Different node types can be edited by using different type-specific interaction tools. The advantage of this approach is that students can design their learning process collaboratively and self-directed. However, in our opinion students have to be supported in planning this process because of their lack of experience in both, problem based learning and self-directed learning. Furthermore, the aspects which are presented in the graphs should not only cover the process of collaboration but also the usage of the technical system and its integration in this process – this means to follow a socio-technical perspective.

Our approach is to intensify the students' reflection of how to carry out their task collaboratively. Our suggestion is that this intensification can be achieved by using the following strategies:

1. CSCL has to be considered as a socio-technical process where the interaction between the students and the application of technical means is highly interwoven (Herrmann 2003). This socio-technical perspective should guide the planning of the students´ collaboration processes.
2. It reveals that it is disadvantageous to confront the students with completely finalized plans of collaboration. In contrast we suggest a participatory approach where the students can themselves develop a plan of how they want to work together and use the system. This strategy was inspired by the idea of transferring the methods of the participatory design of software systems (for an example Kensing et al., 1998) with the design of a socio-technical system as a whole (Herrmann et al., 2004). The students' sessions, where they planned their cooperation, were facilitated, that means that the socio-technical process was developed step-by-step following a concept which we call socio-technical walkthrough.
3. Those parts of the task which refer to the socio-technical process of collaboration should not only be described textually, but also provide models which represent the interaction between the students and between their activities, as well as the computer system including computer-mediated communication. These models can be seen as maps.
4. The task description should be permanently available and brought to the students' attention. This requires textual descriptions and process models being permanently available on the system. To enable seamless integration of perception of the process models and use of the system, we suggest offering these diagrams as a

means of support awareness, which navigate the way through the learning material and guide students' contributions. These function as a navigational aid emphasizing the role of the diagrams as representational guidance.

5. These strategies were found by using explorative investigations in field studies where computer-mediated communication and document exchange were used to support collaborative learning. Subsequently we analyze our assumption of the usefulness of graphical process models in an experimental setting.

EXPERIMENTAL FIELD STUDY: THE RELEVANCE OF GRAPHICAL PROCESS MODELS

Setting

We conducted our experimental field study to test the assumption that **preparing the collaboration with the help of graphical process models leads to better results than when just working with text.** Our notion of *better* refers to the degree of using the system and of exchanging and integrating knowledge. The study was embedded in a seminar "consequences of information technology" at the University of Dortmund (Germany) in winter term 2003/2004. 24 students participated in the seminar (21 male and 3 female). In the seminar, groups of three students had to prepare a presentation and a thesis/paper upon given topics. Therefore subtasks like collecting material, preparing a table of contents, a reciprocal review of developed material had to be carried out. The students had access to the system LiveLink™ to support and document their collaboration.

The experiment was related to the seminar's phase of reciprocal reviews in which two group members had to give a (written) review to the other student about her/his prepared presentation. For the experimental field study the following setting was arranged:

- Eight groups of three students took part in the study. Each group met in a 1.5h face-to-face session.
- In the session, each group had to develop a detailed plan at the process of collaboratively writing reviews.
- The sessions were moderated. Therefore two moderation methods were used: a traditional method using traditional visualisation aids (meta-plan, flipchart) and the socio-technical walkthrough which uses graphical process models (socio-technical walkthrough method, c.f. Herrmann et al. 2004). In the following these two methods are named as the condition "without model" and "with model". Due to our small sample, we neglected to compare the condition "with model" with a third condition "without moderation". This consideration is further underpinned by our teaching experiences which led us to the assumption, that students have to be supported while planning their collaboration. The participants were randomly assigned to the conditions. The two conditions did not differ by gender. 4 moderators were involved. Each moderator facilitated a session in each condition to reduce the influence of his/her characteristics on the experiment.
- Preliminary to the session, each group of students received the same detailed instructions about the task and disjunctive information about the system LiveLink™, and organizational aspects. Therefore, one student did not know the same aspects of technical and organizational conditions as the others in her/his group. The students should discuss these aspects in the session, but they were not allowed to bring the instructions into the session. The disjunctive instructions were given to the students to allow us to observe the exchange of information during the discussion. To collect data on the information exchange, all participants were asked to complete questionnaires both before, as well as after the session.
- In developing the plan of the collaboration process, the groups had to reflect on how the system LiveLink™ could be used in preparing the reviews. The students developed possible plans as to how to proceed and discussed how the system LiveLink™ could be used. The students agreed on a plan which covered certain aspects such as deadlines and responsibilities. In the condition "without model" the results were summarized in checklists (as a kind of text, e.g. a "To Do"-plan on the flipchart, see fig. 2). In the condition "with model" the result was a graphical process model (see fig. 3), which was produced with the help of an editor.[1]
- After the sessions, the students started to work on their reviews which had to be finished within one month.

[1] We have carefully considered the question whether the usage of a computer system under the condition "with model" would influence the results. However, in our opinion there are no disturbing effects, as firstly only moderators used the system, and – in the without model condition – the moderators produced a clearly readable text documentation of the students' contributions. Secondly, the participants in both conditions were computer science students who had frequently worked with computer systems. Since computer science students are more familiar with modeling methods than people with another background, it should be mentioned that a simple modeling method was used which has proved as easily understandable (Herrmann et al., 2004).

Assumptions and Hypotheses

Our assumption was that the usage of models during the preparation of the collaboration leads to better results (in comparison to the usage of checklists). Better results are operationalized by:

Knowledge exchange: We assume that focusing on process models leads to a better knowledge of the collaboration process (in comparison to the usage of checklists). This assumption supposes that process models enable a structured presentation of exchanged knowledge. This presentation conveys the communication of both aspects – the CSCL-system and the process of cooperation. Our hypothesis is that:

Hypothesis 1 (H1): *Students in the condition "with model" mention more aspects which are part of others' given instructions in the questionnaire filled in after the session than students in the condition "without model".*

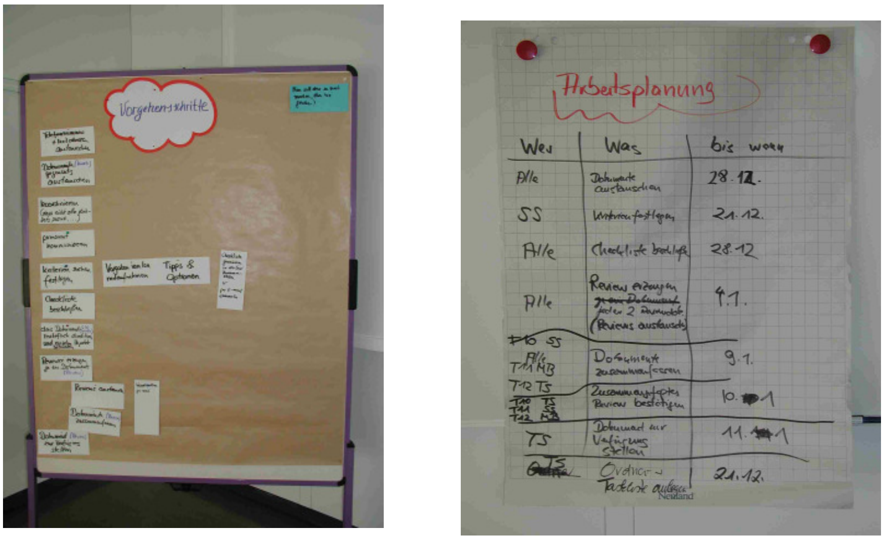

Figure 2: Visualization of tasks (left) and To Do-plan (right) in the condition „without model"

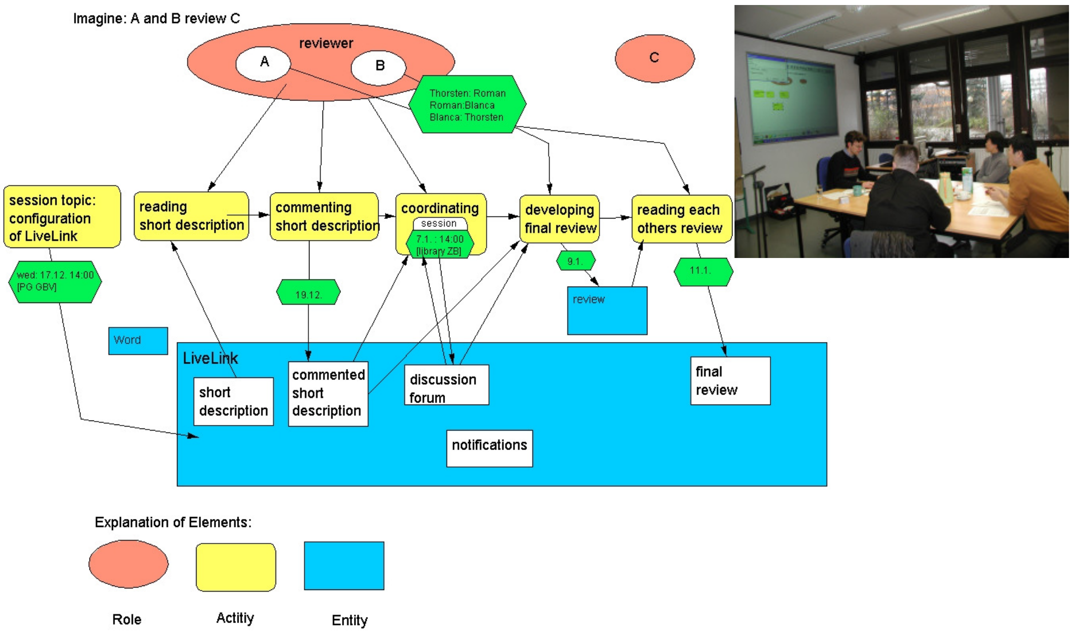

Figure 3: Example of a process model as it was developed during a session. The original text is translated. The explanations of the modelling elements have been added.

Integration of exchanged information during the group discussion in the artefacts: During the planning of the collaboration process, the group members exchanged their knowledge about the CSCL-system and how to use it. We assume that the planning discussions reveal differences with respect to the multiplicity of aspects which are found in the plans being developed during the group sessions. The number of all items contributed during the session can be seen as an indication of the complexity of the collected information that can potentially be taken into account when generating agreements for the collaborative process. These items are contained in the visualisation of the group discussion (text based vs. graphical process models). Although our experiment supposes that the condition "with model" leads to a better planning process, this assumption does not coercively imply that more items are collected under this condition. It could also be the case that the "without model" group produces a higher number of items which are superficial or may not be consequently used for the planning process. Therefore, the following hypothesis is non-directionally formulated:

Hypothesis 2 (H2): The two conditions differ in the number of items which are contained in the visualisations of the plans.

In addition, it is interesting to see how many commitments groups made using the collected information. A statement is a commitment when a specific cooperation task is assigned to a deadline or to a person. For example the agreement "task management has to take place in the system" is not a commitment in contradiction to "person B adds task in the systems on Monday". We were specifically interested in the commitments regarding the usage of the CSCL-system, as we wanted to encourage the usage of the system. The group can make its own decision as to how and if the system is used. We presume that the use of process models helps groups to organize their work. This means more commitments about the usage of the CSCL-system are made and collected pieces of information are more utilised. To test this assumption we a) identified how many commitments a group made in relation to all collected information and b) we identified how many commitments a group made regarding the usage of the CSCL-System. Our hypotheses are:

Hypothesis 3 (H3): Taking into consideration all collected items there are more commitments in the condition "with model" than in the condition "without model".

Hypothesis 4 (H4): Within all collected items there are more commitments related to the use of the CSCL-system in the condition "with model" than in the condition "without model".

Furthermore we expected that the groups in the condition "with model" would introduce more aspects about the socio-technical design into the artefacts in comparison to groups in the condition "without models". Such aspects relate to the functionality of the CSCL-system (e.g. tasklists or use of discussion forums) and the organizational arrangements for the use of the system (e.g. naming responsible moderators for discussion forums). Before the sessions the information about these aspects was given to the participants in the instructions. We hypothesize that:

Hypothesis 5 (H5): In the condition "with model" more aspects related to socio-technical design are embedded into the artefacts, compared with the condition "without process model".

Usage of the CSCL-system: We want the students to use the system in a self-motivated way and suppose we can encourage them to do so by means of using our specific approach. If the usage of process models leads to a better knowledge of the collaboration process in the group, it can be presumed that group members in the condition "with models" develop more common ideas about the cooperation process with the CSCL-system and that more binding agreements regarding the usage of the system were made. These should lead to a more intensive usage of the CSCL-system and the execution of joint tasks. We expect that these groups access the system more often and are overall more active users of the system. The usage of the system was measured by writing reviews during the collaborative work and thereby counting the logged events in CSCL-system. Furthermore, we analysed which functions of the system had been used by group members in the two conditions. We hypothesize that:

Hypothesis 6 (H6): In the condition "with model" the number of logged events during the process of writing reviews is higher than in the condition "without model".

Data collection

Data used to survey the knowledge exchange process related to the collaborative process was gathered in the pre-post-design[2] by means of a written questionnaire. The questionnaire we used to collect information about the

[2] Pre-post design means that the same questions have to be answered before and after the session.

system LiveLink^{TM}, how it was used for the preparation of reviews and the cooperation within the group. The questions were:

- How can your group use the LiveLink^{TM} system to develop reviews?
- Which functions of the LiveLink^{TM} system can be used to do this?
- Which agreements could be made within the team to help facilitate cooperation, as to how the system should be used?

The integration of exchanged information into the developed artefacts (meta-plan visualization, and ToDo-lists vs. graphical process models) was analyzed for the survey. Logfiles were analyzed to look at the actual use of the LiveLink^{TM} system during the preparation of the reviews (after the group sessions).

RESULTS

Knowledge exchange

How often knowledge was exchanged was tested by comparing the numbers of aspects mentioned in the questionnaire. Table 1 and fig. 4 are related to the first hypothesis. They show group statistics for those aspects which were part of the instructions and were contributed to the group discussion. "Pre" means before the moderated session and "post" means after the session. There is no significant difference between groups pre-test-scores and the latter had no significant effect on post-test-scores ($B = 0.16$, $t = 0.87$, $p = 0.39$)[3] The analysis showed that the average number of aspects mentioned increased after the session in both conditions, whereas the value of post-test-score in the condition "with model" is significantly higher than in the condition "without model". We can conclude that in the condition "with model" the participants exchanged more information aspects amongst each other about the CSCL-system and work organisation than in the condition "without model". Consequently, hypothesis 1 is accepted.

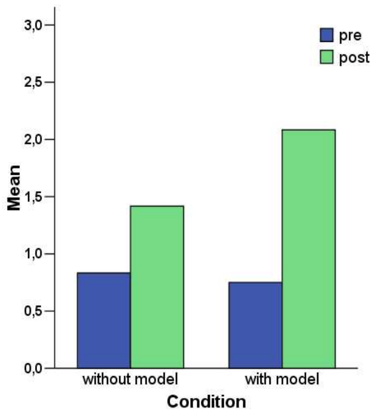

Figure 4: Group statistics showing the average of mentioned aspects

	without model		with model		t (df = 22)
	M	*SD*	*M*	*SD*	
pre	0.83	1.19	0.75	1.14	0.18
post	1.42	0.90	2.01	1.0	-1.72*
N	12		12		

Table 1: Group statistics and t-test statistics related to mentioned aspects; *p =< .05, one-tailed t-tests.

Integration of information into the developed artefacts

The integration of collected information into the developed artefacts was tested by analysing the visualised outputs (in checklists in the condition "without model" and in diagrams in the condition "with model") produced during the group sessions.

Variables	without model		with model		t (df = 22)
	M	*SD*	*M*	*SD*	
A (no. of general contributions to the discussion)	27.50	4.34	19.25	5.19	4.23***
B (no. of socio-technical design aspects)	8.25	4.14	13.50	2.39	-3.81***
C (quotient general commitments/contributions)	0.29	0.03	0.34	0.05	-2.61
D (quotient commitment LiveLink^{TM} usage / contributions)	0.12	0.03	0.31	0.04	-13.53***
N	12		12		

Table 2: Group and test statistics of the variables on the output of group discussion; ***p<.001;
A: Two-tailed t-test; B, C and D: one-tailed t-tests.

[3] Because the building of groups was randomised, a t-test for independent samples to compare the post-test-scores was used. Since the size of the sample is small, the pre-test-scores were compared and their effect on the post-test-scores were identified by covariance analysis. The independent t-test was chosen as there is no significant difference between groups pre-test-scores and the latter had no significant effect on post-test-scores.

It turned out, that the groups in the condition “without model” produced more contributions during the discussion than the groups in the condition “with model” (Variables “A”, table 2, fig. 5) (H2 is accepted). We conclude that the visualisations of the discussion in the condition “without model” contained more pieces of information and were more complex than in the condition “with models”. In contrast, the groups in the condition “with models” reached more agreements related to the CSCL-system, and at the same time utilised the collected information better, because of the fact that the number of commitments in relation to the number of all visualised discussion items was higher (variable “D”, table 2, fig. 5). This cannot be said of all commitments (variable “C”, table 2, fig. 5). If we look at all commitments, there is not any significant difference between the conditions (H4 is accepted, H3 is rejected). Furthermore it has shown that in the condition “with models” the visualised output covered significantly more points linked to socio-technical design than in the condition “without model” (variable “B”, table 2, fig. 5). Hypothesis 5 is accepted. If we look at table 2 we can conclude that the participants in the condition “with model” were more able to integrate the information (given in the instructions) into the group plans.

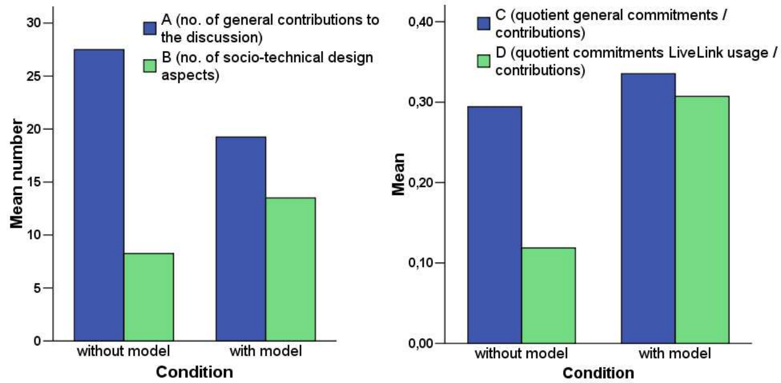

Figure 5: Group statistics of the variables to output of group

Usage of LiveLink™

The analysis of the logfile showed that the students in the condition “with model” were significantly more active in the CSCL-system than the students in the condition “without model”. The number of activities in the system in the condition “with model” amounts to 2433 and in the condition “without process model” it amounts to 1231 ($\chi^2_{(1)} = 394.32$, $p < .001$). Fig. 6 shows which activities this concerned. Fig. 6 shows also that the students in the condition “with model” were more active in almost all of these activities: They searched more documents in folders (browse), positioned more documents (create), downloaded more documents (fetch), viewed more documents (view), and were more active in the discussion forums (discussion), than the students in condition “without process model”. Hypothesis 6 is accepted. In this regard the students in the condition “with model” were using the system LiveLink™ intensively for their cooperative work.

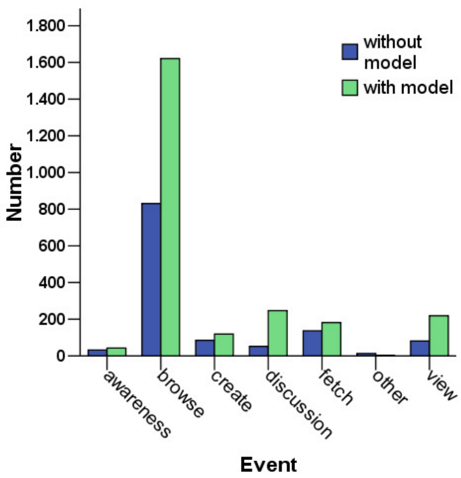

Figure 6: Number of activities in system

Furthermore it should be mentioned that 22 students found the session used to plan the collaboration very helpful. They also regarded the moderation during the sessions as very helpful.

The presented results indicate that the condition “with model” leads to better results concerning the exchange of knowledge about the collaborative process. It also improves the development of commitments related to the use of the CSCL-System and the integration of learned content about socio-technical design in the cooperation plan. It also promotes the using of the CSCL-system better than the condition “without model”.

CONCLUSION AND FURTHER RESEARCH: INTEGRATION OF GRAPHICAL PROCESS MODELS INTO CSCL-SYSTEMS

The experimental field study presented in this paper revealed that the usage of graphical process models during the preparation of the collaboration can lead to more knowledge exchange and integration, as well as commitments concerning the collaborative learning process, and a more intensive and collaborative usage of the

CSCL-system. However, further studies will have to observe, whether the combination of an intensified collaboration process and working on a certain problem might cause a “burn out” effect for the students.

To test the influence of models on the CSCL-process our next step is the integration of the process models into the CSCL-system in order for them to be continuously available, and to serve as a representational guidance. Representational guidance means the design of a software system that enables the software itself to facilitate the collaborative learning (Suthers and Hundhausen 2002). To demonstrate the integration of coordinative process models, we use a CSCL prototype (KOLUMBUS, Kienle and Herrmann 2003). It supports collaborative learning by using an integrated view on communicative contributions (annotations) and material (text, multimedia elements). This content structure can be intertwined with such graphical process models as those developed in the sessions of the experiment.

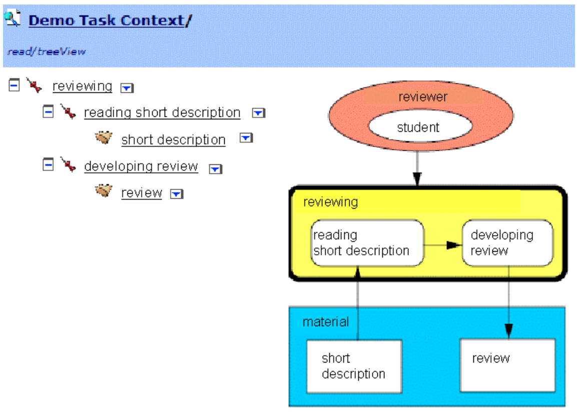

Figure 7: content structured by tasks

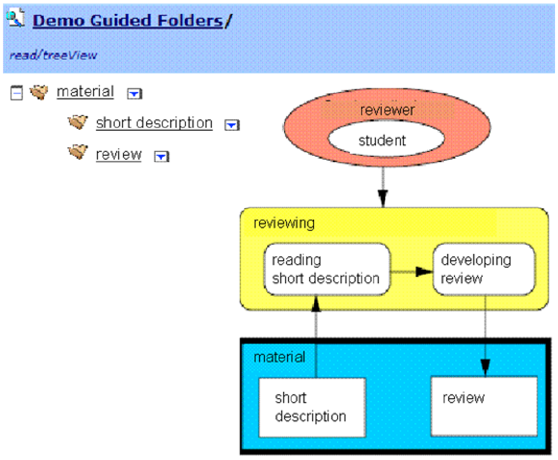

Figure 8: content structured by material

Our concept is that a model can be developed and modified with the help of an external editor (SeeMe-Editor), which then enables users to develop models with a semi-structured modeling notation SeeMe (Herrmann & Loser 1999). This editor has already been used in the sessions of the condition “with model” for our study. Because the semantic of the elements of the SeeMe-models can be consistently interpreted, the model itself has a guiding character and can be interpreted for the integration into the CSCL-System.

Before a model (as shown in figure 3) can be integrated into the CSCL-System, it has to be aesthetically improved. After this improvement, a specially designed import functionality offers the possibility of integrating the collaboratively developed SeeMe-model in all CSCL-systems which use XML like KOLUMBUS does. The model is used to structure a (sub-)area of the systems content. For example, for each activity in the process model, a task can be created and assigned. These tasks can be combined with a deadline and awareness mechanisms which indicate the progress of the task completion. For each entity, a folder is created which can be combined with a link to already existing material. When integrating the model into the CSCL-System, the user can decide, whether the sub-area should be structured in accordance with the tasks (see fig. 7) or with the material (see fig. 8).

After the import of the process model, an integrated view on the created (sub)-area and the graphical process model is presented (see fig. 7 and 8). This integration allows the students to use the model not only to prepare and plan the collaboration but also as an artifact (with underlying functionality) which accompanies the whole computer supported collaborative learning process: the graphical elements of the process model are linked to the folders, documents and statements which represent the learning material and discourses of KOLUMBUS. Thus, it will be possible to use the diagram to navigate through the content of the learning system and to relate the content to the planned and ongoing process. We assume that the continuous work with the model internalize their way of collaboration and increase the competence for self regulation. Our further research concerns an evaluation of the influence of these integrated models on the computer supported collaborative learning process.

ACKNOWLEDGMENTS

We thank Gerry Stahl and Martin Wessner for their helpful comments on earlier versions of this paper and Michael Prilla for implementing the prototype of integrating process models into KOLUMBUS.

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