Supporting Well-Being in Virtual Learning Teams – An Explorative Study

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ABSTRACT

In this paper, we….

Keywords

Small group learning, etc.

In most studies on collaborative learning and on computer-supported collaborative learning include teams or groups which work together only for a very limited amount of time, typically for the amount of time necessary to complete the psychological study. Also, members of such (pseudo-) teams typically have not interacted before the study started and will not interact closely with each other after this episode. For such ad-hoc groups, completing the task (solving the problem) imposed from somebody outside of the group is the main concern. This exclusive focus on work on the task is inadequate in cases where group members work/learn together for longer time periods and for situations where the group affects the life of members outside of group sessions.

If learning groups are to work together for more than a couple of hours, for instance in form of a learning community where members work together for weeks and months (Bielascyk & Collins, 2000), then groups have to maintain a certain level of coherence and stability. From this point of view, groups need not only to focus on getting their task(s) done, but also have to attend to more psychological factors concerning the well-being of the group as a whole and the well-being of their individual members. For instance, McGrath (1991) suggested in his TIP theory three functions "real" groups have to attend to: working on the common task (*production function*), maintaining the communication and interaction among group members (*group well-being*), and helping the individual member where necessary (*member support*).

What is true for face-to-face groups is particularly true for groups whose members communicate (partially) indirectly with each other via low-bandwith communication channels such as chats or discussion boards. Presumably, such virtual groups need to be even more thoughtful on maintaining a high level of coherence and well-being because of the lack of immediate feedback and the types of information-lean feedback which is typical for technology-mediated communication. For instance, social cues are lost when communication is confined to media which do not convey information about non-verbal aspects of others' behavior and appearance (Kiesler & Sproull, 1992).

We focus on supporting groups with respect to establish the necessary level of group well-being. Our approach rests on the consideration that a necessary prerequisite for virtual teams to attend to group dynamics is to be aware of the members' motivational and emotional state. In particular, groups need to be aware of members who at a given moment in time have motivational and/or emotional problems (with their work and role in the group). Without such awareness, the group as a whole has no basis for adapting to individual and/or collective problems. We experiment with techniques to (a) dynamically over time *elicit* emotional and motivational state from individual group members and (b) to *feed this information back* to the group as a whole, making use of *visualization* techniques to highlight such aspects as trends over time and deviations of individual trends from the group mean. In other words, we focus on turning individual motivational and emotional experiences into knowledge that is shared by all group members. We are furthermore interested in how groups make use of such information once it is available to them. For

instance, do they attend to group members who signal problems and how so? Finally, we are interested in the effects of such concerns for group well-being on the outcomes of group work and on learning outcomes.

Learning Communities

Collaborative learning can be organized and orchestrated in a number of ways (e.g., Slavin 1995). The specific form of group learning we are focusing on has be coined "learning community approach". Learning Communities (LCs) are groups that focus on building shared knowledge and by in that manner way also gain individual knowledge (Bielascyk & Collins, 2000). Characteristics of LCs are the collaborative extension of individually and socially shared knowledge, the possibility of sharing and discussing knowledge, the support of learning by doing, the enhancement of metacognitive (group) processes and the formation of an group identity. One of the most famous examples of virtual LCs is Scardamalia's and Bereiter's CSILE (e. g. Scardamalia & Bereiter, 1994; Scardamalia, Bereiter & Lamon, 1994).

In difference to work-related groups or communities of practice, the central purpose of a LC is the common knowledge construction, the socially shared sense making (Dillenbourg, Baker, Blaye & O'Malley, 1995). The most important way in order to reach this goal is dialogue, e. g. a sequence of questions and answers. This basic communications process can be divided into three parts (Fischer, Bruhn, Gräsel & Mandl, 1998): (1) *Externalisation*: Learner A shares his or her task-related knowledge with others; (2) *Elicitation*: Learner A arranges that learner B or others share their knowledge, especially related information according to learner A's externalisation (e.g. A asks another learner or the whole group); (3) Consensualisation: Deviant opinions and understandings are a main trigger for learning processes. Initiated by identification of a conflict there is a need for consensus. This consensus could be an extension of one's or a group's knowledge or a restructuring of existing knowledge structures. Without the guidance of a teacher or a tutor, consensus oriented Learning Communities are dependant of social coordination, social grounding and the external representation of knowledge. These external representations play an important role, because they are an excellent opportunity to reflect a group's actions.

We describe next the kind of representations that our learners can use to share knowledge about their work on the task and then the manner in which we elicit and visualize socio-emotional experiences of group members. We should mention at this point that the task we use does not require a long phase of problem solving and we did in this exploratory study employ ad-hoc groups which worked together for only a number of hours. It is left to forthcoming studies to analyse the effects of measures such as the ones demonstrated here on groups that work together for a longer time.

LEARNING TASK AND LEARNING ENVIRONMENT

Learning Task: Information Design

The task we give our groups is devived form information- and didactic design. Learners have to develop a online screen version of a linear text. Basically this task requires to put the given text into coherent parts, add or delete parts, provide adequate headings and develop a navigation structure. As usual in design tasks, there is not one "right" solution, but it is possible to solve the task in different ways. The overall objective is to get to know and apply basic principles of information design. As our learners have no previous experience in this kind of task, we provided them with an informative hypertext with the required information.

Learning Environment: Shared Whiteboard

The elementary workspace for collaborative online working has been developed by....

*****hier Beschreibung Easy Disc******

The explicit argumentation structure is based on the Ibis-notation (Conklin, 1993).

Easy Discussing provides more possibilities than just productive shared workspace features. A quantitative analysis of learners' behaviour is computed in real-time and can be used to give direct in feedback, e. g. graphical charts displaying the relative and absolute number of submitted postings. This functions allows to detect deviant behaviour like "spamming" or insufficient behaviour like social loafing. This allows members of a group to search for possible

causes and to plan and make interventions. With this action-based analysis of collaboration we support work the "production level" according to McGrath (1991). But with the loss of audio-visual communication derive other problems in interaction that may have substantial influence on a group's well-being. In a face-to-face situation, important resources for interpersonal communication are facial expression, intonation and prosodic stimuli. With less channels in communication these resources are missing. In chat or email-communication there are so-called emoticons but they are a poor substitution: They lack of temporal dynamics and they do not change automatically with a sudden change in mood. In order to avoid these problems we have developed a further diagnosis-component. In a determined interval every learner will be asked about his current mood and motivation on a short scale. The results of these question are again directly displayed to the whole group. By that means upcoming difficulties or problems regarding group interaction can be identified early and compensated. We have evaluated the function and effects of automatic recording and direct feedback of the interaction protocols and motivational-emotional tracking in a pilot study.

+++ hier auch noch das web-formular, mit dem das abgefragt wird.

*****hier oder vorher ggf. noch was zur automatischen Analyse*****

EXPLORATORY STUDY

Design of the study

Subjects were randomly assigned to small groups of three members each. Nine subjects (= three groups) participated in an experimental condition with the tracking of interaction and motivational as well as emotional parameters directly displayed as feedback to each whole group. The other nine (also three groups) subjects in the control condition did not get any automatic feedback about interaction, motivational and emotional parameters. The task for all groups was the same: To collaboratively re-design a linear text into a didactically designed online-text. This design task had to be fulfilled by using the easy discussing tool. In order to provide further information a hypertextual information base for didactical screen design was available online. All subjects had to do a multiple-choice pre- and a post-test regarding knowledge about didactical screen design as well as to fill in a short scale about preferences for group learning and competitiveness.

Materials and Tools

The basic collaboration platform has been provided through the online collaboration tool Easy discussing developed at the Duisburg University (Mühlenbrock, Hoppe, Jansen, 2001). There were two different user interfaces for the groups. In the experimental condition Easy Discussing provided a shared workspace with cards for performing the task (restructuring a linear text into a online version), annotation cards for argumentation purposes which have been structured similar to the IBIS-method. In addition they also had a chat-interface which was also pre-structured like the annotation cards, a browser which provided an overview about the shared workspace, and a feedback panel, where there quantitative and qualitative amount of each members contribution was displayed.

Control group had a similar Easy Dicussing tool but without feedback panel and without the chat-interface. In oder to discuss decisions they only had to use the annotation cards that had to be erased after their use. Figure 1 and figure 2 show the different versions of Easy Discussing.

Figure 1: Easy Discussing in Experimental Condition

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Figure 2: Easy Discussing in Control Condition

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Necessary background information for accomplishing the task has been provided by an online instructional hypertext. This where also subjects emotions and motivation where surveyed: In intervals of 30 to 40 minutes they were asked to fill in a 5-pooint Likert-scale "How are you?" and "How are you motivated to work on this task?". The values of each entry and each subject was displayed to experimental group members using an dynamic Microsoft Excel © Graph. These results were not shown in control group. Figure 3 shows a prototype diagram.

Figure 3: Emotional and Motivational Feedback

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In order to assess subjects knowledge concerning the task we developed a multiple choice test with 16 items which was used as pre- and post-test. Another scale from Neber (19??) to measure subjects' preferences for small group learning and competition in learning has been used to gain control data.

Procedure

The experiment started with a general introduction into the handling of Easy discussing and the internet browser. After the introduction pre-test and introduction into the task was given. Then subjects ha about 2 hours time to work collaboratively on the task and collect necessary information form the online information resources, connected over the internet in different rooms. After these 2 hours the online post-test was applied.

Sample

Overall 18 subjects in 6 groups participated in this study. All were students at the University of Heidelberg with different majors aged between 21 and 42 years (mean = 26,2, s =. 5,46; 11 female and 7 male). All subjects received 40 DM (~ 20 US$) for their participation.

Hypotheses

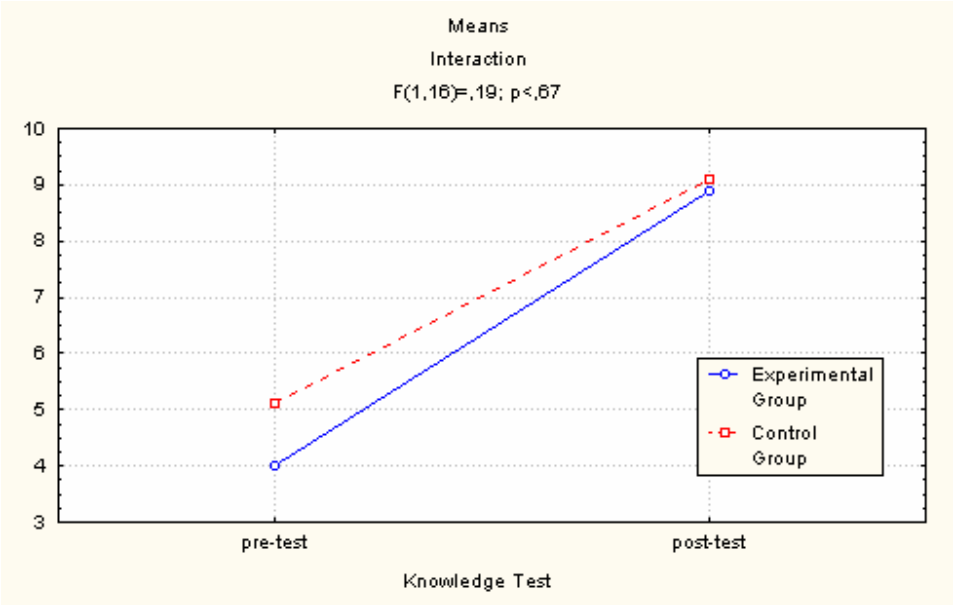
Beneath the explorative character of this study we expected influences of the feedback functions we used in this experiment. In specific we expected that the reflection of' subjects' participation behaviour should lead to an increased and equally distributed participation.

Furthermore we expected that the feedback of emotional and motivational parameters should influence corresponding group processes.

The chat-interface should provide for a more reflective discussion, i.e. subjects should make more references to previous dicussion topics, because this material is accessible. In control group there is hardly a tracking of a groups design history. Thus there should be less references to prior discussion topics.

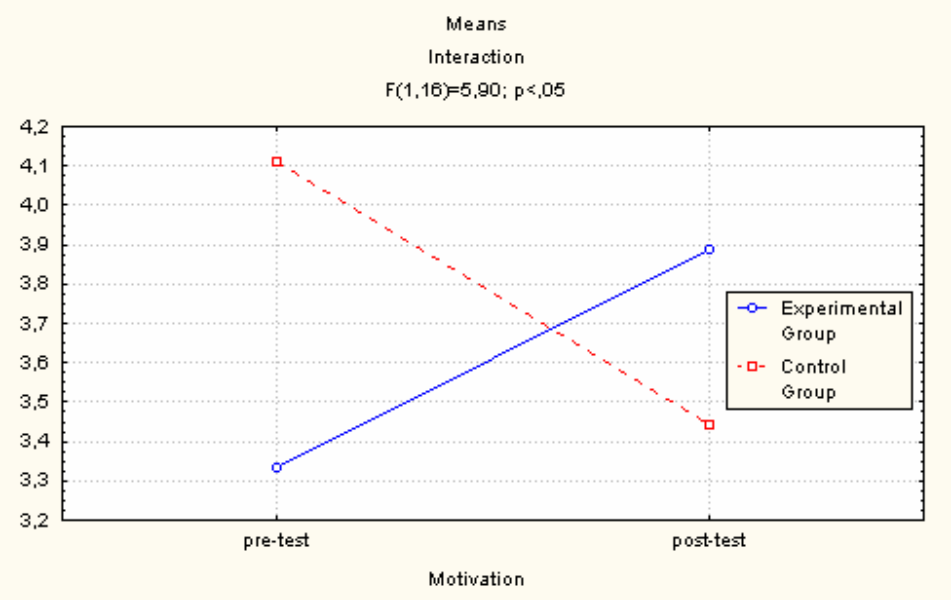
Results

The results of subjects's performace in the pre-test concerning knowledge revealed no significant differences ($F(1, 16) = 0{,}54$, $p = 0{,}47$; Mean of experimental group (EG) = 4 correct out of 16 answers, s = 3,08; mean of control group (CG) = 5,11, s = 3,33). There were also no differences in-between both groups in post-test performance ($F(1, 16) = 0{,}1$, $p = 0{,}92$; mean EG = 8,89, s = 3,76; mean CG = 9,11, s = 5,25). Both groups mastered the post-test significantly better than the pre-test ($F(1, 16) = 19{,}42$, $p < 0{,}001$) while interaction between both tests and groups was not significant ($F(1, 16) = 0{,}19$, $p = 0{,}67$; see figure ???).



Results of the questions how subjects of a group actually feel do not show significant differences between both groups in pre-test (F (1, 16) = 0,7, p = 0,79; mean EG = 3,56, s = 0,88; mean CG = 3,67, s = 0,87) and post-test (F (1, 16) = 0,0, p = 1; mean EG = 3,67, s = 0,25; mean CG = 3,67, s = 0,5). There was not pre-post effect (F (1, 16) = 0,8, p = 0,78) as well as no significant interaction between repeated measurement and experimental condition (F (1, 16) = 0,8, p = 0,78).

Concerning the motivational parameter there were also no differences in pre-test (F (1, 16) = 3,38, p = 0,09; mean EG = 3,33, s = 1; mean CG = 4,1, s = 0,67) and in post-test (F (1, 16) = 0,94, p = 0,35; mean EG = 3,89, s = 1,11; mean CG = 3,44, s = 0,78). While there were also no differences between pre- and post-test (F (1, 16) = 0,5, p = 0,83), the interaction of repeated measurement became significant (see figure ???).



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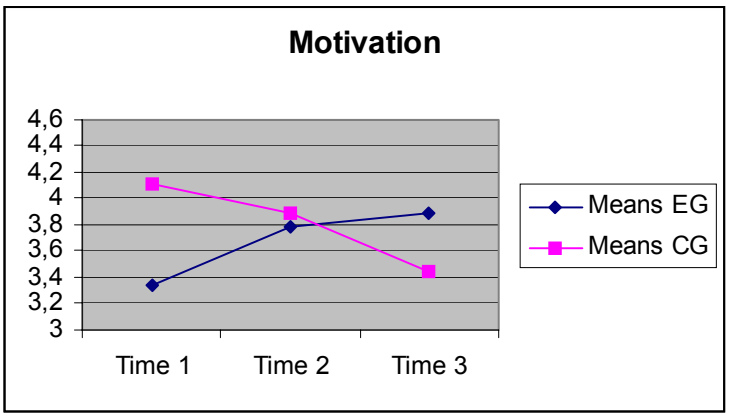


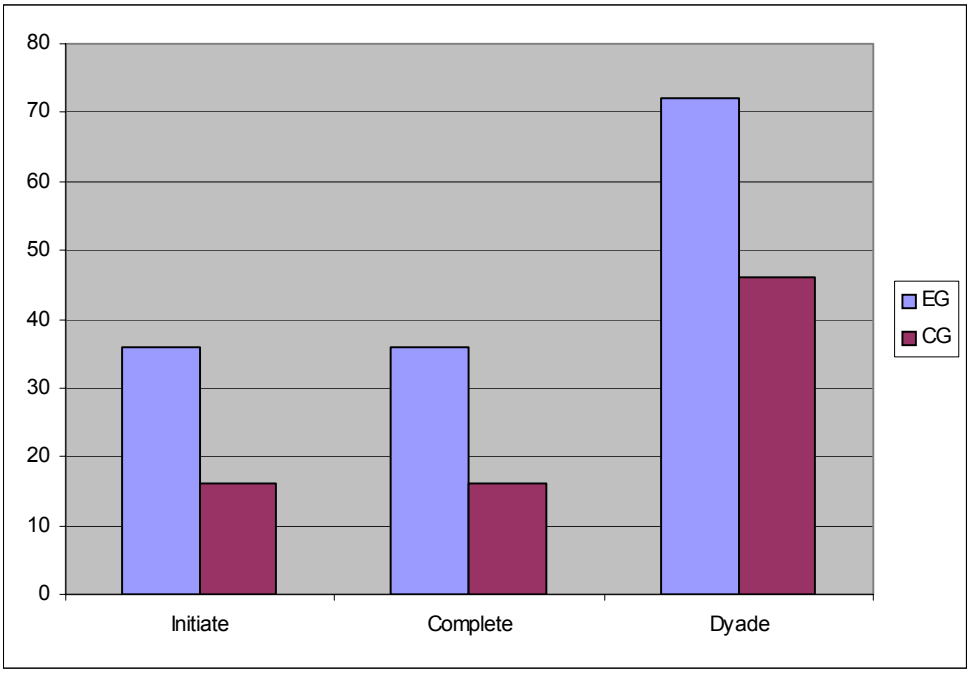
Pattern Analysis Oder wie man das nennen soll?

hier noch wie man zu den Patterns kommt

An overall value of all created objects has been computed. This includes in EG all postings in the chat-window and the shared workspace, in CG all nodes created in the shared workspace. An ANOVA revealed no significant difference between overall number of postings in both conditions ($F(1, 16) = 0{,}16$, $p = 0{,}70$; mean EG = 32,67, s = 17,36; mean CG = 29,78, s =13,47). Additional analysis concerning added edges reveals also no significant different between both groups ($F(1, 16) = 0{,}22$, $p = 0{,}64$); mean EG = 8,78, s = 9,08; mean CG = 11, s = 10,62).

A more detailed view on subjects' discussion structures showed a more frequent use of pro and con postings in experimental group (pro: $F(1, 16) = 5{,}33$, $p < 0{,}05$; mean EG = 6,11, s = 6,31; mean CG = 1,1, s = 1,54; con: $F(1, 16) = 5{,}62$, $p < 0{,}05$; mean EG = 3, s = 3,64; mean CG = 0,11, s = 0,33). There were no significant differences in use of idea and question postings (ideas: $p = 0{,}56$; mean EG = 6,55; mean CG = 4,78; questions: $p = 0{,}96$ mean EG = 8,22; mean CG = 8,0).

Analysis of automatic detected interaction patterns in subjects' discussion shoed no significant differences between both groups in categories of initiating a collaboration ($F(1, 13) = 1{,}16$, $p = 0{,}3$; mean EG = 4; mean CG = 2,28) and completing an initiated collaboration ($F(1, 13) = 1{,}07$, $p = 0{,}32$; mean EG = 4; mean CG = 2,28) whereas dyadic interactions became marginally significant ($F(1, 13) = 3{,}11$, $p = 0{,}5$; mean EG = 8; mean CG = 4,29). The following figure shows the absolute values for both groups:



SUMMARY AND DISCUSSION

Computer supported collaborative learning is influenced by many parameters. In this paper we stressed the role of external representation as a results out of a group's natural interaction. These interactions can be recorded and by means of graphical representation used as immediate feedback to a group. By that way a groups computer-mediated communication serves itself as additional information resource that may influence itself. In our experiment we investigated the role of of feedback on different parameters of collaborative learning and group processes. We used a complex design task to figure out how explicicit and implicit protocoling and its resuse for subjects' information resource influences subjects' group behavior, problem.solving, knowledge acquisition as wells as emotional and motivational parameters. In fact we did not find significant influences on subjects' knowledge acquisition. We found that both experimental conditions have been a powerful way to learn the basic principles of knowledge design concerning instructional hypertexts.

Furthermore we detected no influence of feedbacking indivuals' emotional state to the whole group. This may be due the short time the experiment was running. In this time the emotion might have been to stable to be influenced by the task and the problem-solving process.

We found an influence of feedbacking groups motivational parameters. Although there were no differences between the experimental groups there was a significant interaction between time of measurement and experimental condition. This effect indicates that some processes in computer supported can be influenced in a positive manner by means of a steady tracking of parameters outside the task itself and its immediate feedback to a group.

Further analysis of this experiment and additional experiments are needed to investigate the role of this kind of protocols and their feedback in detail.In further research, we will in increase and refine the number of parameters utilized to assess and visualize group well-being. For instance, we will also include sociometric measures such as centrality of a member in a group. In addition, we will record not only traces of emotional-motivational and interactional aspects of group work, but also trace the work on the task (e.g., design histories).

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