Promoting the Coordination of Computer-mediated Interdisciplinary Collaboration

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ABSTRACT

The goal of this research is to promote the coordination of computer-mediated interdisciplinary collaboration of partners with complementary expertise. Efficient collaboration is shown to depend strongly on the quality of the coordination activities. A first experiment investigated the effects of different technical realizations of computer-mediated collaboration on the coordination of activities. It revealed that especially a well-balanced sequence of phases of joint work and individual working phases was central for the quality of the problem-solving process. The goal of a second experiment was to test the effectiveness of promoting this coordination by vicarious learning from an exemplary computer-mediated collaboration. By combining two strands of research – studies on worked-out examples and work on vicarious learning from dialogue and discourse – we show a new and theoretically well-founded way to strengthen collaborative competence.

EXPERIMENT 1: EFFECTS OF DIFFERENT TECHNICAL SETTINGS ON THE COORDINATION OF ACTIVITIES

The goal of the first study (see also Hermann, Rummel & Spada, 2001) was to investigate the effects of different technical realizations of a collaborative setting on the collaborative process and its efficiency. The collaborative task (in both experiments), was the solution of psychiatric case studies. Dyads of advanced medical and psychology students were asked to jointly formulate a diagnosis and a therapy plan making use of their complementary expertise. The main coordination demands (cf. Malone and Crowston, 1990) of the task were to identify and sequentiate different types of activities (i.e. content-related discussion and decisions, writing text) and to identify which parts of the task had to be solved together and which could be dealt with individually. A 2 x 2 design with eight dyads of participants in each cell was implemented varying the following factors: (1) A high-end videoconferencing system with shared text-editor was compared with a more "conservative" system, including e-mail and an audio connection (via telephone). (2) A condition with prescribed collaboration phases was compared with an unscripted condition. In the scripted condition, the goal was to foster an optimal coordination of the collaborative work.

With regard to the *quality of the final solution* the telephone and e-mail conditions turned out to be significantly better than the videoconferencing conditions. The differences in the unscripted conditions can be illuminated by looking at the *collaborative process* itself. In the unscripted condition with telephone and e-mail all work patterns showed collaborative and individual work phases, whereas some dyads in the condition with videoconference and shared text-editor tended to work only collaboratively (4 of 8 dyads). The difference between the two conditions was significant (Chi=5.33, F=1, p=.02). The best explanation of this finding might be that in the videoconference condition the strong support of joint activities kept some dyads from task division and working individually. The result is corroborated by a lower quality of final solutions for those dyads that did not work individually at any time: They produced poorer solutions (AM=.31 percent of met criteria) than dyads working both, jointly and individually (AM=.39). This result is statistically significant (t=1.89, F=1, p=.04, onesided). It is in line with the result, that the scripted collaboration with phases of individual and joint work yielded better solutions.

These results indicate, that the coordination of individual working phases with phases of joint work is of central importance for the quality of the problem solving process and its outcome. However, while a prescription of coordination might work in the initial phase of a collaboration it seems not to be a very promising strategy for longer periods of collaborative work. Therefore, in a second experiment we pursued the goal to have dyads of participants with complementary domain knowledge acquire collaborative competence.

EXPERIMENT 2: VICARIOUS LEARNING FROM WORKED-OUT EXAMPLES OF COMPUTER-MEDIATED COLLABORATION

In the second study, a new instructional measure for promoting the coordination of computer-mediated synchronous collaboration was introduced, which integrates (1) the concept of worked-out examples (e.g. Renkl, 1997), and (2) that of vicarious learning from dialogue and discourse (Stenning, McKendree, Cox, Dineen & Mayes, 1999). The learning effect of a worked-out case study – presented as a model of an ideal collaboration – on process and outcome of a subsequent computer-mediated collaboration (application phase) was to be analyzed and compared to the learning effect of scripted collaborative problem-solving and the performance of a control group. Vicarious learning from the modeled collaboration

was expected to promote students competence to collaborate during the application phase. In comparison, scripted collaboration is known to be an efficient method to support collaboration online. However, the question was whether it had the potential to trigger learning and promote the competence for collaborative work and its coordination. The design of the study is shown in the table below. Two experimental groups and one control group were formed consisting of nine dyads each.

		Vicarious learning from an exemplary worked-out collaboration	**Learning from scripted collaborative problem-solving**	**Control group**
30 min.	**Technical instruction**	✔	✔	✔
15 min.	**Material (case study 1)**	✔	✔	–
120 min.	**Experimental learning phase (case study 1)**	observing a worked-out modeled collaboration	scripted collaboration	–
15 min.	**Material (case study 2)**	✔	✔	✔
120 min.	**Application phase (case study 2)**	free collaboration	free collaboration	Free collaboration
30 min.	**Posttest**	✔	✔	✔

Process and outcome of the dyads' collaboration during the application phase of the experiment were analyzed to investigate the learning effects of the two experimental variations on the promotion of the competence for the coordination of computer-mediated collaborative work and its outcome. To gain information about the *collaborative process*, log-files taken during the application phase were analyzed to identify patterns of individual and joint phases of work. The amount of individual work (in minutes) has been found to decrease from the vicarious learning condition (M = 52,8) to scripted collaboration condition (M = 44,6) and the control condition (M = 40,7). Moreover, the control group showed strongly diverging patterns ($SD_{control}$ = 28.64; $SD_{scripted\ collaboration\ learning}$ = 12.43; $SD_{vicarious\ learning}$ = 11.86) . To corroborate this finding, the difference between model pattern and empirical patterns was analyzed statistically. The exemplary (optimal) length of individual work phases was compared with the empirical data by computing the absolute differences ($M_{vicarious\ learning}$ = 9.33; SD = 7.92; $M_{scripted\ collaboration\ learning}$ = 13.33; SD = 11.35; $M_{control}$ = 26.56; SD = 18.08). The result shows a significantly higher deviation for the control condition and the scripted collaboration learning condition compared to the vicarious learning condition ($F(2,40) = 4.23$; $p < .05$).

Obviously, dyads in the vicarious learning condition learned from the modeled collaboration and therefore showed a coordination pattern similar to the one presented to them in the worked-out example. In comparison, dyads in the scripted collaboration group transferred less from the first (scripted) to the second (unscripted) collaboration. In the control group a considerable amount of collaboration patterns showed much joint activity and not enough parallel individual work, but also a great deal of variance with regard to these variables. It has yet to be proven whether these firsts results can be confirmed by the results for the *quality of the joint solution* as well as the performance on the *posttest*. Further results on those dependent variables will be presented at the conference.

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