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COOPERATION SCRIPTS FOR LEARNING VIA WEB-BASED DISCUSSION BOARDS AND VIDEOCONFERENCING

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Abstract. Computer-supported collaborative learning often means that locally distant learners discuss a task via text-based discussion boards or videoconferencing. Collaborative learning, however, is often sub-optimal with respect to how learners work on the concepts that are supposed to be learned and how learners interact with each other. Collaborative learning environments may be improved by scripts that structure epistemic activities and social interactions of learners. Two studies are being reported that investigated the effects of epistemic and social scripts in a text-based and a videoconferencing computer-supported learning environment. In each study the factors "epistemic script" and "social script" have been independently varied in a 2×2-factorial design. 182 university students of Educational Science participated in the two studies. Results show that social scripts can be substantially beneficial with respect to knowledge acquisition, whereas epistemic scripts apparently do not to lead to the expected effects or even hinder learning.

1. DIMENSIONS OF COLLABORATIVE LEARNING

Collaborative learning builds on the idea that all learners of a group *elaborate* learning material together without direct or immediate intervention of the teacher (Cohen, 1994). For instance, learners may contribute and discuss divergent perspectives upon a theory that is supposed to be learned or discuss problem cases together. The collaborative learners may acquire knowledge as a consequence of being exposed to various perspectives and the need to refine or restructure their own point of view (Webb & Farivar, 1999). Individual group members contribute to joint task solutions, which in turn may change knowledge leading to modified contributions of individual learners (Salomon & Perkins, 1998). At least two dimensions of collaborative learning need to be analyzed: epistemic activity and social mode of co-construction (Fischer, Bruhn, Gräsel, & Mandl, 2002). *Epistemic activities* describe how learners deal with the knowledge construction task, e.g., how they categorize or define new concepts with the goal to (re-)construct knowledge. Learners verbalizing their ideas on how to solve the task may re-structure their knowledge and refer to specific new concepts in order to produce more detailed solutions (Webb, Jonathan, Fall, & Fall, 1995). The *social mode of co-construction* indicates how learners interact with each other, e.g., how they relate their contributions to contributions of their learning partners in performing the epistemic activities. Learners may, for instance, ask each other questions or critically negotiate deviating perspectives and become aware of contradictions within their individual understanding. Learners may resolve contradictions which arise in discourse by

constructing new knowledge (Piaget, 1932/1965; Nastasi & Clement, 1992). Studies to date point out that specific epistemic activities and social interactions are predictive to outcomes of collaborative learning (Cohen, 1994; Fischer et al., 2002; Teasley, 1997).

There are indications, however, that normally, learners do not spontaneously engage in productive epistemic activities and social interactions and consequently, fail to achieve the desired learning outcome (e.g., Cohen, 1994; Mandl, Gruber, & Renkl, 1996). Recent approaches have therefore aimed to facilitate these epistemic activities and social interactions (Ertl, 2003; Weinberger, 2003).2. Theoretical framework

2. SCRIPTS FOR COLLABORATIVE LEARNING

Facilitating collaborative learning can be approached in numerous ways. Whereas some approaches, e.g., moderation of collaborative processes, may require complex skills and highly depend on the quality of the individual facilitator, *scripts* have been regarded as a qualitatively consistent possibility to facilitate collaborative learning activities (O'Donnell, 1999). Scripts are activity programs that aim to facilitate collaborative learning by specifying activities in collaborative settings, sequencing these activities and assigning the activities to individual learners.

Scripts may aim to support specific epistemic and social collaborative learning activities that have proven to be positively related to learning outcome in the respective collaborative tasks. *Epistemic scripts*, for instance, can guide the attention of learners towards specific aspects of the task and towards specific task-oriented activities while collaboratively discussing and constructing knowledge. *Social scripts* can specify and sequence interactions of learners, such as eliciting information from each other by asking critical questions. It is unclear, however, what the different contributions of epistemic and social components of scripts to facilitating collaborative learning really are, because thus far epistemic and social script components have not been systematically compared.

In the context of *computer-supported collaborative learning (CSCL)*, scripts can have different characteristics altogether depending on the type of computer application, which mediates the communication of learners (e.g., e-mail, chat, and videoconferencing). This variety of applications complicates theoretical foundation, systematic research, and design of educational support in the context of CSCL. In the following sections we will present two empirical studies on epistemic and social scripts implemented by prompts into CSCL environments. We analyze the effects of epistemic and social scripts in CSCL environments that are based on two different media types (web-based discussion boards and videoconferencing technologies).

3. TWO EMPIRICAL STUDIES ON EPISTEMIC AND SOCIAL SCRIPTS IN COMPUTER-SUPPORTED COLLABORATIVE LEARNING ENVIRONMENTS

We arranged and investigated two different CSCL environments with epistemic and social scripts: (1) a problem-oriented peer discussion environment based on discussion boards (Weinberger, Fischer, & Mandl, 2003) and (2) a videoconferencing-based peer-tutoring environment (Reiserer, Ertl & Mandl, 2002). In both of these studies we focused on the question, to what extent epistemic and social scripts affect the individual knowledge acquisition of collaborative learning. The *research question* of the studies was: What are the effects of an epistemic script and a social script and their combination on the individual acquisition of knowledge as the outcome of collaborative learning in the computer-supported learning environments? We expected that both scripts would enhance individual knowledge acquisition in comparison with an unscripted CSCL environment. However, the interaction of both epistemic and social scripts would lead to the best learning outcomes, fostering a discourse of productive interactions on a high quality level as regards the contents.

3.1. Study 1: Scripts in Problem-Oriented Collaborative Learning Environments with Web-Based Discussion Boards

Text-based computer-mediated communication in *web-based discussion boards* enables new, *asynchronous collaborative learning scenarios*, in which learners are supposed to engage in more active, reflective, and socially supported knowledge construction (Clark, Weinberger, Jucks, Spitulnik, & Wallace, 2003; Scardamalia & Bereiter, 1996). Students rarely, however, make use of that potential. Ninety-six students in their first semester of Educational Science at the University of Munich participated in this study. The students participated in an online learning session about attribution theory (Weiner, 1985), a standard part of the curriculum, in a text-based online learning environment with an integrated discussion board as communication tool. Participation was required for receiving course credit at the end of the semester. Students were invited individually – each student to one of three different laboratory rooms. Each group was randomly assigned to one of the four experimental conditions in a 2×2-factorial design. Learning partners did not know each other before the experimental session. We varied the factors "epistemic script" (with vs. without) and "social script" (with vs. without). We measured individual knowledge acquisition based on a propositional analysis of written problem case solution of the learners.

Learning Environment of Study 1. Students in all conditions had to work together in applying theoretical concepts to three case problems that were presented as a text in the specifically designed online learning environment, and jointly prepare an analysis for each case by communicating via web-based discussion boards that were integrated in the online learning environment (see figure 1). They were asked to

discuss the three cases using the attribution theory and to jointly compose at least one final analysis for each case.

All groups collaborated in three web-based discussion boards – one for each case. The bulletin boards provided a main page with an overview of all message headers. In this overview, answers to original messages appeared in outline form. The learners could read the full text of all messages, reply to the messages, or compose and post new messages. In the replies, the original messages were quoted out with ">" as in standard newsreaders and e-mail programs.

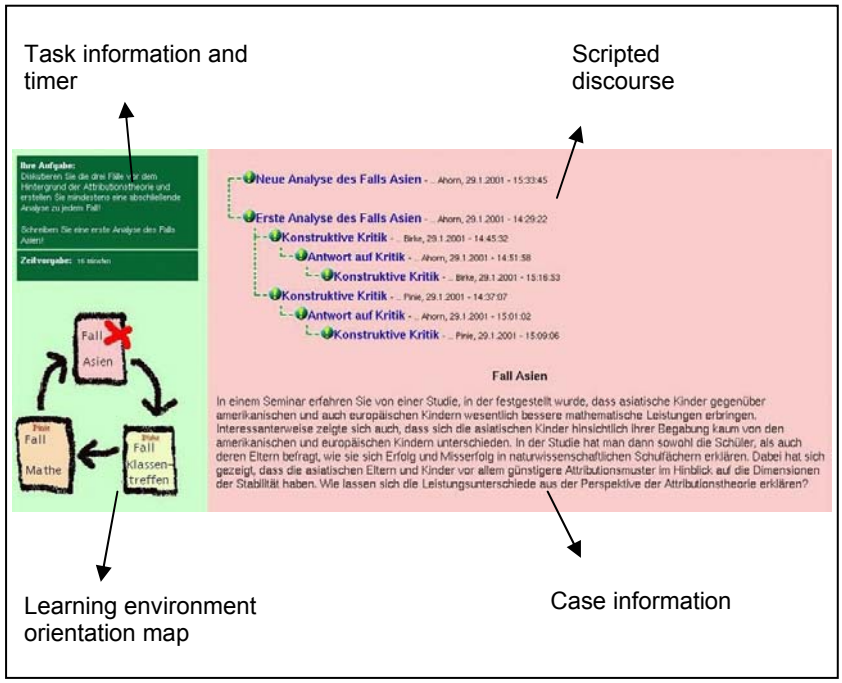


Figure 1. The CSCL environment of study 1 with a web-based discussion board.

Results of Study 1. The post-test analysis shows two main effects of both types of scripts on individual acquisition of knowledge. First of all, ANOVA revealed a large negative effect of the epistemic script. The means of both of the epistemic-script conditions are remarkably lower than the mean of the control condition. Second, there was a medium-sized positive effect of the social script. The learners in the combined scripts condition learned even less than the learners in the control condition. An interaction effect, however, could not be found. These results indicate that the individual acquisition of knowledge could be facilitated with the social script, whereas the epistemic script led to lower gains than the control group. Both

script components did not interact. Thus the results were only partially coherent with our assumption with respect to the negative contribution of the epistemic script.

3.2. Study 2: Scripts in a Videoconferencing Environment

In the second study, we investigated effects of scripts in a *videoconferencing-based peer teaching environment*. Videoconferencing enables synchronous forms of collaborative distance learning, which are required when learners need to interact at high frequency. Eighty-six students in their first semester of Educational Sciences at the Ludwig-Maximilians-University of Munich took part in this experiment. The students participated in an online learning session within the videoconferencing-based peer teaching environment about the theory of genotype environment effects (Scarr & McCartney, 1983), a standard part of the curriculum of Educational Sciences in Munich. Dyads were set up and randomly assigned to one of four conditions in a 2×2-factorial design. We varied the factors "epistemic script"(with vs. without) and "social script"(with vs. without). After the learning session the individual knowledge acquisition was assessed with a combination of a short open answer and a multiple-choice test.

Learning Environment of Study 2. An online learning environment based on a desktop videoconferencing system including audio and video connections and a shared text editor to support the dyads' knowledge construction allowed participants to verbally communicate and jointly create text material at the same time (see figure 2).

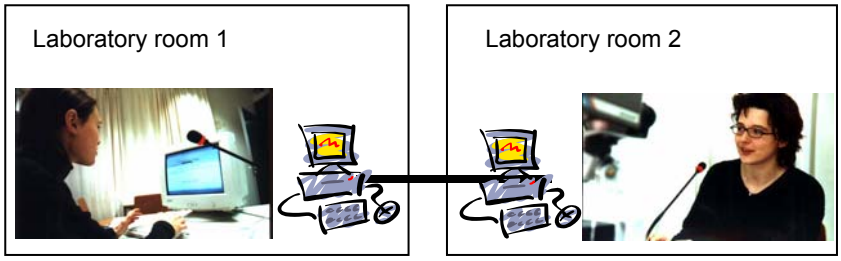


Figure 2. The experimental setup of the videoconferencing setting of study 2 with a learning group of two participants in separate rooms.

The shared application was accomplished with Microsoft Netmeeting 3.01. As text editor we applied MS-Word 2000, an application that we expected to be well known among our participants and therefore easy to handle. This setting enabled the learners to alternately type or edit notes in the text-editor.

Results of Study 2. Concerning learning outcome in study 2, a 2×2-factorial ANOVA was used for analyzing learners' post-test scores. The social script produced a medium-sized positive, but statistically marginal effect. Learners supported by the epistemic script did not differ substantially with respect to

individual knowledge acquisition from learners without the epistemic script. The two scripts did not interact with respect to the post-test scores.

4. CONCLUSIONS

The results of the two studies indicate that unsupported collaborative online learning may result in bad performance (Cohen, 1994), but scripts may facilitate the individual acquisition of knowledge. In particular, it was found that in both CSCL environments the *social scripts* were able to enhance the individual acquisition of knowledge, as was hypothesized. We assume that social scripts may support interactions, which in turn facilitate individual knowledge acquisition (Weinberger et al., 2003). Thus, social scripts may enable learners to actually exploit the aforementioned advantages of collaborative learning and support the elaboration and refinement of individual knowledge in social situations (O'Donnell, 1999; Teasley, 1997). Whereas collaborative learners without support from a social script often build a minimal consensus in order to hastily complete collaborative tasks, social scripts may motivate learners to inquire about the contributions of the learning partners more critically and thereby acquire more knowledge individually than learners without additional support.

In contrast, the *epistemic scripts* of both studies did not show the expected outcomes. In study 1 the epistemic script actually hampered the individual acquisition of knowledge in comparison to the other experimental groups. As a consequence, epistemic scripts may not be generally recommendable for facilitating collaborative learning. Epistemic support can make specific aspects of the learning task salient and suggest specific knowledge-building activities (Ertl, 2003; Fischer et al., 2002; Reiserer et al., 2002). Therefore, it is of utter importance, to take note of the aspects of collaborative tasks at which epistemic scripts aim, which epistemic activities are suggested by the scripts and the extent to which learners are supported by the scripts to elaborate the learning material. In order to improve epistemic scripts, we need to investigate what specific epistemic activities should be fostered that are related to elaboration of learning material and with what kind of script design this may be achieved in various computer-supported learning environments.

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