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Scripts for Facilitating Computer Supported Collaborative Learning

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INTRODUCTION

Many distance learning scenarios, for example, virtual seminars, use collaborative arrangements for learning. By applying them, they offer learners the chance to construct knowledge collaboratively. However, learners often do not possess the skills necessary for a beneficial collaboration. It is therefore important that learners are offered support in these learning scenarios. Scripts for collaborative learning can provide support. They can guide learners through their collaboration process (Ertl, Kopp, & Mandl, 2007b) and help them to acquire collaboration skills (Rummel & Spada, 2005).

Scripts for collaboration were originally developed in order to support text comprehension. They facilitate two or more learners—who are similar as far as their existing knowledge and learning strategies are concerned—in their efforts to understand contents provided by theory texts. Collaboration scripts split this process into a sequence of smaller steps, assign each learner to a particular role, and offer a number of comprehension strategies, such as questions, feedback, and elaboration. Each one of these learners has a defined role to play, which in turn is associated with certain strategies and varies within the different phases.

One example of a collaboration script is the so called MURDER script (Dansereau, Collins, McDonald, Holley, Garland, Diekhoff et al., 1979; O'Donnell & Dansereau, 1992). It was originally developed to help individuals with text comprehension, and was then increasingly used in pair and group work. The MURDER script divides the learning process into six phases and introduces individual and collaborative activities.

Learners begin in Phase 1 by preparing themselves for the task ahead (mood). In Phase 2 they then each read the text for themselves, and pay particular attention to its main arguments and facts (understand). One partner (Partner A) then repeats the content from memory (repeat), and the other gives feedback and clarifies any discrepancies or misunderstandings (Partner B; detect). Phase 5 involves the learners working together and elaborating the text by connecting it to their existing knowledge and experiences, and sometimes by using imagery (elaborate). In the final phase, the learners go over the text again (review). These six phases can be repeated for several text paragraphs. Partners A and B take turns in repeating and detecting mistakes in the content.

This example clearly demonstrates the basic characteristics of a collaboration script:

- Learners work their way through the text step-by-step (sequencing)
- Learners are given different roles to play, for example, the "repeater" or the "detector" (assignment of roles)
- Collaborative use of strategies to aid comprehension (collaborative strategy use)

Much research was dedicated to the use of collaboration scripts in text comprehension (e.g., O'Donnell & Dansereau, 1992, 2000; Palincsar & Brown, 1984; Patterson, Dansereau, & Newbern, 1992), particularly as this skill is of great importance in school and university education. A number of studies have confirmed the

positive effects of the scripts on learning. Rosenshine and Meister's (1994) metastudy, for example, provides an overview of existing results.

BACKGROUND

In order to understand how collaboration scripts work, it is necessary to view each characteristic, especially sequencing, role assignment, and collaborative strategy application, individually.

Sequencing

The creation of a number of different steps according to which task should be carried out is one of the most basic characteristics of a collaboration script, but at the same time, it is one of the least specific. An example of these different steps is the aforementioned MURDER script. The sequencing is particularly good for collaborative learning, as it shows the learner how best to carry out the task at hand and provides an effective strategy to do so (Kollar, Fischer, & Hesse, 2003; Weinberger, 2003). However, the issue is raised as to whether a sequencing of various subtasks in itself can have an effect on the learning results, or whether it merely provides a framework in which the learner can assume various roles and hence work through the text.

Assignment of Roles

The assignment of roles may have two effects on the process of collaboration itself. First, certain internal strategies or images can be applied (Dreitzel, 1972). According to the role taking theory, a learner that has been assigned to the role of an "explainer" is more likely to apply strategies the learner has experienced from other people that the learner saw as talented "explainers" of new concepts. A learner in the role of "examiner" is more likely to ask critical questions. However, these strategies, which the learner associates with the given roles, do not necessarily have a positive effect on learning; particularly if the learner lacks a certain distance to the allocated role (Dreitzel, 1972). If, for example, a learner has a particularly authoritarian view of a teacher, the learner may apply this to the learning situation and thereby prevent comprehension questions and discussion. In order to avoid this kind of situation, the strategies that are applicable to each

role must be well trained in advance (Rosenshine & Meister, 1994), and it is important that each learner gets a chance to take on all of the roles. Second, the assignment of roles may result in the learners learning more actively. The learner who assumes the role of the teacher or explainer may particularly benefit from the collaboration script, as the role is connected with an active function (Renkl, 1995). Studies have shown that learning by teaching has a strong positive effect on learning (Renkl, 1995).

Collaborative Use of Strategies

The sequencing of tasks and assignment of roles usually only provide the framework for the collaborative use of text comprehension strategies by learners (Reiserer, 2003). The strategies are usually based on strategies for use by individuals (Mandl, Stein, & Trabasso, 1984). The individual strategies acquire new qualities through the collaboration between the learning partners, particularly the questions, feedback, and explanations. Throughout most phases of the collaboration script, the collaboration partners use different strategies, which are well suited to each other and to the learning phase (O'Donnell & King, 1999; Palincsar & Brown, 1984; Reiserer, 2003; Rosenshine & Meister, 1994; Rosenshine, Meister, & Chapman, 1996).

The influence of typical strategies in collaboration scripts was summarized in the aforementioned metastudy by Rosenshine and Meister (1994). The original studies, upon which the metastudy was based, involved between 2 and 10 strategies for intense study of the material in reciprocal teaching.

The four basic strategies in the reciprocal teaching approach are:

- **Clarifying:** The learners test how well they have understood the text by clarifying issues in it. The answering of the questions inspires them to place more emphasis on particular information, whereby the partner who is asking the questions has the opportunity to clarify any misunderstandings. Brady (1990) found positive effects of clarifying in a study, but made the point that these effects are dependent upon the difficulty of the theory text used.
- **Summarizing:** The summarizing of the text passages is a further strategy. The learners have to focus on the basic message of the text and

then formulate it in their own words. According to Brown and Palincsar (1989), the learners can use this method to test whether they have understood a text passage. The partners can check each other's summaries, add any missing information and draw attention to any irrelevant information. This strategy has been connected with learning outcome in a number of studies (Rosenshine & Meister, 1994).

- **Questioning:** The students are presented with the task of generating questions about the text and then posing them to each other and answering them respectively. These questions are split into general questions about the main content of the text, and more detailed questions. In order for the questioner to be able to formulate questions about the text, the questioner must have read it thoroughly, as must the partner, who must be able to answer and elaborate on the questions. Rosenshine and Meister (1994) however, did not find a direct connection between ability to ask questions and leaning success. This may have something to do with the fact that it is necessary to focus on a particular type of question for the text comprehension to be reinforced (Person & Graesser, 1999), and this is often not the case.

- **Predictions:** The learners attempt to make predictions about the next paragraph of text based upon what they have read up to now. The strategy aims to provoke an intense elaboration and the activation of learners' prior knowledge. This strategy has however not yet been researched into to any great extent, although first results suggest a positive effect.

Rosenshine and Meister (1994) reach the conclusion that the clarifying and summarizing strategies achieve the best results when used in collaborative learning. However, one has to be aware that the learners were intensively trained in these strategies before the application was tested; on average the learners took part in 20 instructional units. A more detailed description of the training and the support provided can be found by Rosenshine et al. (1996).

COLLABORATION SCRIPTS IN COMPUTER SUPPORTED LEARNING

In addition to the "original" collaboration scripts that are most often used in face-to-face classroom learning situations, there is a growing trend of using collaboration scripts in computer networks (Fischer, Kollar, Mandl, & Haake, 2007). It is particularly important that learners are offered enough support in these learning scenarios, as it is often the case that the learners do not know each other very well (Walther & Burgoon, 1992), and the communication process over the Internet can be difficult (Finn, Sellen, & Wilbur, 1997). For this reason, collaboration scripts were adapted in various ways to be more suited to computer supported learning. This has lead to a number of methods of structuring learner interaction in computer supported learning (Fischer et al., 2007). These collaboration scripts are applicable to a wide range of learning material, for example, to learning with case studies (Ertl, Kopp, & Mandl, 2007a), to collaborative problem solving (Rummel & Spada, 2005), to the improvement of argumentation (Weinberger, 2003), or communication skills in network collaboration

Table 1. Collaboration script in videoconferencing according to Ertl et al. (2005).

	Student in the teacher role	Student in the learner role
Phase 1 Communicate	Explaining the text content	Posing of comprehension questions
Phase 2 Deepen the understanding	Giving of feedback	Repetition and noting of received information in a joint document
Phase 3 Reflection	Individual reflection and elaboration of the joint document	Individual reflection and elaboration of the joint document
Phase 4 Discussion	Discussion of the content of the text, based on reflection with partner	Discussion of the content of the text, based on reflection with partner
Both partners then read the next text passage. The roles are swapped. The procedure is repeated until the entire text has been analyzed.		

(Baker & Lund, 1997). These collaboration scripts all have one thing in common: in contrast to traditional collaboration scripts, they do without intensive training because they are immediately implemented in the computer supported communication.

There are, however, a number of differences between collaboration scripts intended for use in verbal communication, such as video conferencing (Ertl, Reiserer, & Mandl, 2005; Ertl et al., 2007b; Rummel & Spada, 2005), and those intended for use in written communication, such as discussion forums or chat (Baker & Lund, 1997; Weinberger, 2003).

Collaboration scripts in videoconferencing are usually similar to the original collaboration scripts, but do not include the training, as this is made difficult by the distance between the participants. The individual steps are therefore often induced by the education setting. Table 1 contains an example of a collaboration script with two roles and four learning phases that was applied in a videoconferencing setting (Ertl et al., 2005).

The results of this study show that task solving in videoconferencing can be made more efficient by the additional use of a collaboration script. It is also possible to prevent inefficient processes (Reiserer, 2003; Rummel & Spada, 2005). The emphasis of the scripts however is, as can be seen in the example, on the sequencing and role taking (Ertl et al., 2005; Rummel & Spada, 2005). The strategies for intensive processing of a text are encouraged by the collaboration script, but cannot be trained before the task is carried out due to the network scenario. There are few studies that have found a positive effect of collaboration scripts on individual learning results in the area of collaboration.

The application of collaboration scripts in text-based computer mediated communication scenarios is very different to those in face-to-face settings or in videoconferencing. In these scenarios, the collaboration script is usually implemented as a particular structure shown on the computer screen, often supported by prompts. This structure may be demonstrated using communication suggestions, for example, "I would suggest that…" that are entered into a chat window when selected. Baker and Lund (1997), for example, report a script, which specifically directed the collaboration process. Their learning environment provided a shared graphics editor for working on a collaborative product and the instructional design added several *speech act buttons* to this editor. Each time a learner had made changes to the collaborative product, the learning environment

required both partners to agree on these changes before continuing; they were required to demonstrate this by pressing the respective speech act buttons. The intention of this mechanism was that both learning partners increased their grounding (Dillenbourg & Traum, 2006) and their collaborative commitment to the joint product (Baker & Lund, 1997).

To sum up, the results of studies that focus on text-based communication scenarios are similar to those that focus on videoconferencing. The collaboration scripts often show effects during the task solving, but the effects on the individual's learning outcomes are not consistent. Some collaboration scripts appear to have a positive effect, while others even seem to prevent knowledge gain (Weinberger, 2003).

CONCLUSION

Several studies have shown that scripts can facilitate computer supported collaborative learning (e.g., Fischer et al. 2007). These scripts work differently to scripts in face-to-face scenarios. Scripts for face-to-face scenarios require extensive trainings of the strategies provided by the respective script (Rosenshine et al., 1996). As a result of these trainings, the strategies are internalized by the learners and provide them with long-term effects. In contrast, scripts in computer mediated communication try to get by without training. Alternatively, the strategies of these scripts are induced by implementation in the learning environment. This reflects the peculiarities of computer mediated communication because spatial distance prevents learners to take part in trainings. Unfortunately, they often miss the long-term effects evoked by the trainings.

However, it is not enough to merely compare scripts in a face-to-face scenario with scripts in computer mediated communication. This is because scripts for computer mediated communication have to deal with several constraints, in the communication scenario as well as in learners' characteristics. They face the problem that learners usually do not know one another very well and that they may be inexperienced in the computer mediated communication scenario. Consequently, the role of scripts changes in computer mediated communication. Instead of merely being focused on the outcomes of a learning session, they concentrate more on learners' collaboration processes. They try to provide learners with a beneficial collabora-

tion environment to allow them to engage in beneficial collaborative learning processes.

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KEY TERMS

Assignment of Roles: Collaboration scripts often require learners to adopt certain roles during the collaborative learning process.

Clarifying: Strategy of discussing and resolving comprehension difficulties in a given text.

Collaborative Learning: Method of learning by which a group of learners collaborates to achieve improved learning results.

Collaboration Script: An aid to collaborative learning, in which the learning process is divided into various stages.

Predictions: Strategy of splitting a text into various paragraphs in which the users attempt to make a founded guess at what the next paragraph will discuss.

Questioning: Strategy in which learners pose and answer questions about the content of a text to one another to enhance their comprehension.

Sequencing: The method of dividing of a learning process into a number of stages.

Summarizing: Strategy of condensing the content of a text, so that the important details are clearly visible.

Text-based Communication: Collaboration partners communicate by typing statements with their keyboards. This style of communication does not necessarily take place in real time. Examples of text-based communication are e-mails, chat, and forums.

Videoconferencing: Users use Web cams and headsets to have a face-to-face conversation via Internet. Videoconferencing is often combined with the use of a shared application to enable users to work collaboratively with the same software tool.