Supporting Discourse in a Synchronous Learning Environment: The Learning Protocol Approach

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ABSTRACT
Lack of coordination and coherence among contributions is a typical problem with the use of chat for netbased learning. We propose so-called learning protocols to increase coordination, coherence, and, hence, the efficiency of learning via chat. Learning protocols are system controlled cooperation scripts: Participants explicitely identify the reference and the type of their contributions, and the order of contributions is predetermined. As an example, the explanation protocol is described and empirical results confirming that structured discourse leads to superior learning are presented.

Keywords
Cooperative learning, learning protocols, cooperation scripts, netbased learning

INTRODUCTION
We focus on the usefulness of synchronous text-based chat for cooperative learning discourses. In traditional face-to-face settings, the effectiveness of cooperative learning is well established (Slavin, 1995). Cooperation can be further improved using so-called *scripted cooperation*. Scripted cooperation implies the application of a more or less rigid schema, i.e., a set of rules and stages according to which the cooperation proceeds (O'Donnell & Dansereau, 1992). Empirical evidence with respect to positive effects on knowledge acquisition is mixed, though generally supportive (Huber, 1999; Slavin, 1995). However, according to Hesse, Garsoffky and Hron (1997), there are special problems with discourse in virtual environments: (i) lack of *social awareness*, (ii) insufficient *group coordination*, (iii) deficient *coherence* of contributions. What we call *learning protocols* are types of scripted cooperation, which are completely controlled by the system (Pfister et al., 1998), and intended to overcome the deficiencies of virtual discourses in cooperative learning environments.

LEARNING PROTOCOLS
A learning protocol requires that learners make explicit what is usually implicit in face-to-face discourse. We define learning protocols by four features: (1) *Explicit reference*: For each new contribution, the referred to concept (word, sentence) is explicitly specified. The reference is represented by an arrow visible for all learners. (2) *Typed contributions*: For each contribution, its type is explicitely specified, such as a question, an explanation, etc. (3) *Role assignment*: Each participant is assigned a definite role such as learner, tutor, explainer, or commenter, depending on discourse type. (4) *Message sequencing*: The succession of contributions is controlled according to a pre-determined pattern.

The Explanation Protocol: An Experimental Test
The explanation learning protocol instantiates a discourse of type "mutual explanation" (Hron et al., 1997), in which a complicated concept is explained. A tutor serves as the main source of knowledge. The explanation protocol works like this: (i) The topic is introduced by a short initial text; (ii) each learner has to contribute in turn; (iii) a contribution is made by first indicating the reference, second, the type of message is selected (Question, Explanation, or Comment), then the message is send to the public chat pane; (iv) depending on the message type, the next contributor is determined: if a question has been asked, the tutor is required to give an explanation; otherwise, the next learner is required to submit his contribution.

We compared a net-based discourse using the learning protocol with an equivalent discourse using conventional free-text chat as a control condition. Additionally, the type of knowledge was varied: one domain was "earthquakes", and the second domain was a philosophical topic on "knowing and believing". A total of 24 subjects participated in the study, put together in groups of three, in a distributed setting. Participants worked through both knowledge domains successively (max. 25 min.). The learning goal for the earthquake domain was "to understand the causes and consequences of earthquakes", for

the philosophy domain "to understand the meaning of the concepts knowing and believing". Directly following each session, a knowledge test was applied.

The effect of the learning protocol was tested with the test score of the knowledge tests as the dependent variable (range 0 to 17). The mean scores in the earthquake domain were 12.08 (SD = 2.65) for the experimental condition, and 8.67 (SD = 1.93) for the control condition. As expected, participants in the experimental condition learned significantly more than participants in the control condition, $t(22) = 3.61$, $p < .01$. The mean test scores for the philosophy domain were 9.04 (SD = 1.59) for the experimental condition, and 8.21 (SD = 1.54) for the control condition; the difference turned out to be not significant.

DISCUSSION

Note that the results are preliminary based on a small sample (N = 24), and only a post-test was applied. We are currently running experiments using a larger sample and a pre-post-test design. However, the positive effect of the learning protocol in the earthquake domain is quite strong, and in the philosophy domain the difference is in the expected direction. This confirms the potential of learning protocols to enhance immediate knowledge gains from net-based discussions. It also shows that the efficiency might depend on the type of knowledge domain.

Several questions remain and need to be studied further. Which features of the learning protocol are essential for knowledge acquisition? The need to indicate the referent of each contribution is assumed to lead to a more coherent cognitive representation; if a coherent representation in fact mediates learning gains is an open question. The role of message typing is also far from clear. Not entirely unexpected is the finding that learning protocols work better in some knowledge domains than in others. One might assume that the explanation protocol is better suited for declarative knowledge acquisition in science or technology oriented domains, whereas other learning protocols might be better suited for philosophical or ethical domains.

ACKNOWLEDGMENTS

This research is funded by the German Research Council (DFG) as part of the priority program "Net-based knowledge communication in groups". Many thanks go to Martin Wessner, Mareike Hennings, Werner Müller, Mareike Geisen and Annette Conzelmann for valuable comments and for conducting the experiments.

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