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Computer-supported collaborative inquiry learning and classroom scripts: Effects on help-seeking processes and learning outcomes

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Abstract

This study examined the influence of classroom-script structure (high vs. low) during computer-supported collaborative inquiry learning on help-seeking processes and learning gains in 54 student pairs in secondary science education. Screen- and audio-capturing videos were analysed according to a model of the help-seeking process. The results showed that the structure of the classroom script substantially affects patterns of student help-seeking and learning gain in the classroom. Overall, students in the high-structured classroom-script condition sought less help but learnt more than those in the low-structured classroom-script condition.

Keywords: Classroom script; Computer-supported collaborative learning; Help seeking; Inquiry learning

1. Introduction

Applying collaborative inquiry learning to science education entails the joint involvement of learners in scientific activities such as searching for literature, formulating hypotheses, and gathering and interpreting scientific data. These tasks are considered to be highly challenging and even overwhelming if they are not adequately supported, for example, by scaffolding, small group scripting and expert support (Kollar, Fischer, & Slotta, 2007; Linn, 2006). A central question pertains to whether students appropriately use the help that is available in a classroom (e.g., teacher, peer learner, computer). So far, we know that students often refrain from seeking help from their peer learners or their teacher when conducting typical inquiry tasks, such as formulating hypotheses or interpreting data (Van Joolingen, De Jong, Lazonder, Savelsbergh, & Manlove, 2005).

Not asking for help when it is needed is not a problem that is exclusive to collaborative inquiry learning classrooms; help-seeking research has indicated that this phenomenon is widespread across a variety of educational settings (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003; Newman, 2000; Ryan, Pintrich, & Midgley, 2001). Research findings in other areas of help seeking indicate substantial inter-learner variability with respect to help-seeking behaviour and further suggest that better help seekers also learn more (Ryan & Shim, 2006; Webb, Ing, Kersting, & Nemer, 2006). The literature also indicates that help seeking processes can be affected by patterns of classroom interaction and facilitated by instruction (Aleven et al., 2003; Karabenick & Newman, 2009; Oortwijn, Boekaerts, Vedder, & Strijbos, 2008). To date however, there has been little research on the question concerning how different patterns of classroom interaction (also termed classroom scripts) in collaborative inquiry learning support or hinder help seeking processes (see also Nelson-Le Gall, 1981). Methodologically, research in the area of help seeking has so far primarily been questionnaire-based, and there is a clear need for empirical studies including measures of help-seeking behaviour and consequential learning outcomes in real learning contexts. The present study examined the effects of different classroom scripts in collaborative inquiry learning on

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help-seeking processes and learning outcomes in the science education classroom.

1.1. Help-seeking process

Research on inquiry learning has repeatedly shown that the inquiry process can be demanding and challenging for students and may thus hinder further learning (Van Joolingen et al., 2005). One reason for this may be that learners are unable to deal with these demanding processes in a way which involves seeking help from peer learners and teacher. We suggest conceptualising processes associated with such problems as *help-seeking processes* and refer to the model developed by Nelson-Le Gall (1981) in which different stages of help seeking are distinguished: (a) becoming aware of a problem, (b) making a decision to seek help, (c) identifying an appropriate source of help, such as peers, teacher, or technology, (d) implementing strategies for getting help, and (e) evaluating the help received.

Learners who are able to self-regulate their learning processes are also able to identify their problems and indicate whether and what kind of help they need to successfully solve a problem (see Newman, 1998; Puustinen, 1998; Webb & Palincsar, 1996). Help-seeking behaviour which enhances help seekers' independent problem-solving, that is, instrumental help (Nelson-Le Gall, 1981), and which includes asking for explanations and hints, is seen as particularly beneficial for learning. However, in order to increase the probability of receiving meaningful help, learners must be able to adequately formulate a request so that help givers can respond to the help required in a specific manner and are willing to provide assistance (Webb et al., 2006; Webb & Mastergeorge, 2003). Help seekers should subsequently utilise the received help to solve a problem or complete a task (Webb et al., 2006). It is, therefore, important to also investigate the type of help received and the usage of the help received.

Help-seeking is a process which is highly socially interactive, especially in the classroom context (see Karabenick & Newman, 2009; Ryan & Shin, 2011). In seeking help, it is necessary for a learner to approach others. For many learners, this step might be crucial and to some extent explain why help-seeking is often avoided (Butler, 2006; Karabenick & Newman, 2009; Ryan et al., 2001). It would, therefore, seem important to investigate how classroom interaction affects students' help-seeking behaviour in order to support interaction in a way that enhances the kind of help-seeking behaviour which in turn fosters learning.

1.2. Classroom scripts for inquiry learning

Previous research on help seeking has shown that teacher behaviour and the resulting classroom discourse might substantially encourage or hinder student help-seeking (Butler, 2006; Karabenick & Newman, 2009; Oortwijn et al., 2008). Brophy and Good (1986), for example, claim that different patterns of classroom socialisation (e.g., teacher-student or student–student interactions, actual instruction, teacher and student expectations etc.) can partially explain variation in students' learning and academic success (see also Nie & Lau, 2010). The term "script" as used by Schank and Abelson (1977) refers to culturally shared as well as personal knowledge regarding, for example, how persons act in a particular situation, such as in a restaurant, or in a classroom (see also Kollar et al., 2007). Both teachers and learners have cognitive representations of typical lesson structures and sequences of learning activities in the classroom (Webb & Mastergeorge, 2003). We refer to the cognitive representations of typical lesson sequences as *classroom scripts* which guide both teachers and learners in their understanding and help them to act in specific classroom situations (see Seidel, Rimmele, & Prenzel, 2005).

Classroom scripts can be seen as one mechanism by which teaching and learning practices are conveyed from one generation to the next, with future teachers internalising scripts over thousands of hours of experience as students (Britzman, 1991). What can be observed in the classroom is the classroom interaction pattern, and this pattern is influenced by the classroom scripts of the participating learners and teachers as well as by the constraints and affordances of the instructional context at hand. In practice, classroom interaction patterns may well to a large extent be determined by the cognitive classroom scripts since mental representations have been found to be rather similar among the actors in a given instructional situation, and the constraints and affordances in western classrooms are impressively homogeneous and constant over time (Schratzenstaller, 2010).

Inquiry learning is seen as a rather student-centred form of learning in which students are actively involved in the construction of knowledge by building hypotheses, gathering evidence and interpreting results. However, teachers are often not well trained in embedding this innovative and student-centred form of learning into their lessons; a fact which might result from "technology assimilation", with the teacher being guided by their traditional classroom script and using materials for inquiry learning to support their own rather teacher-centred method of instruction (see Cognition and Technology Group at Vanderbilt, 1997; Slotta & Linn, 2009).

Alternatively, this may be the result of a "replaced-by-technology" mindset, with the teacher activating a kind of "spectator script" as though they were attending the demonstration of a technology designed to take over the role of the instructor. A small-scale study on web-based inquiry learning, for example, found that the presence versus absence of a teacher in such a role does not even influence students' learning outcomes (Martiny, 2005). While the classroom interaction pattern arising when teachers assume such a passive role has not been analysed with respect to help seeking and help providing, it can be assumed that students also accept the new role distribution and thus refrain from asking for help from the observing teacher. We refer to this phenomenon as "expertise inhibition"; while the teacher possesses domain knowledge, the classroom interaction pattern poses a barrier when it comes to teachers and learners making use of this knowledge.