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Learning to argue online: Scripted groups surpass individuals (unscripted groups do not)

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ABSTRACT

Students often face process losses when learning together via text-based online environments. Computer-supported collaboration scripts can scaffold collaborative learning processes by distributing roles and activities and thus facilitate acquisition of domain-specific as well as domain-general knowledge, such as knowledge on argumentation. Possibly, individual learners would require less additional support or could equally benefit from computer-supported scripts. In this study with a 2×2-factorial design ($N = 36$) we investigate the effects of a script (with versus without) and the learning arrangement (individual versus collaborative) on how learners distribute content-based roles to accomplish the task and argumentatively elaborate the learning material within groups to acquire domain-specific and argumentative knowledge, in the context of a case-based online environment in an Educational Psychology higher education course. A large multivariate interaction effect of the two factors on learning outcomes could be found, indicating that collaborative learning outperforms individual learning regarding both of these knowledge types if it is structured by a script. In the unstructured form, however, collaborative learning is not superior to individual learning in relation to either knowledge type. We thus conclude that collaborative online learners can benefit greatly from scripts reducing process losses and specifying roles and activities within online groups.

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1. Introduction

Command of argumentative skills has been regarded an important competency as well as an important component of science education (Erduran & Jiménez-Aleixandre, 2007). Students are supposed to learn to participate in argumentative discourse in the respective scientific fields. In particular, students should be able to warrant and qualify their claims and to draw inferences on complex, open-ended problems based on theory and observations. Regular seminar settings, however, rarely foresee opportunities for students to equally participate in what has been termed *argumentative knowledge construction* (AKC; e.g., Weinberger & Fischer, 2006). AKC is an approach that describes the acquisition of domain-specific and argumentative knowledge through the elaboration of the learning material by constructing and reviewing arguments. Some studies indicate that text-based online learning environments facilitate equal participation in AKC by allowing students to take the time and resources they need to construct elaborated arguments (Marttunen & Laurinen, 2001; Schellens & Valcke, 2006).

Argumentative elaboration activities, such as examining evidence and reasoning for one claim or another, may sometimes impede task performance or range of task aspects being covered, i.e., the quality and extent to which groups or individuals can solve a problem. However, argumentative elaboration activities are considered to be strongly linked to individual knowledge acquisition, i.e., the amount of knowledge that learners can transfer from a collaborative or individual learning phase to a later point in time as a residue in the learners' individual minds (Baker, 2003; Nussbaum, 2008). Accordingly, it is a challenge to scaffold learners in accomplishing challenging argumentative tasks and simultaneously, to problematise aspects of the tasks, e.g., through prompting learners to provide evidence for their claims or to identify counter-arguments to a specific problem solution, which might otherwise be overlooked (Asterhan & Schwarz, 2007; Reiser, 2004).

AKC can be arranged as a collaborative or individual activity. After years of research on prior conditions of these different learning arrangements (see Slavin, 1993), the focus of research on learning in groups has shifted to analysis of processes of collaborative learning (Dillenbourg, Baker, Blaye, & O'Malley, 1995). We argue that by analysis and facilitation of the processes of individual and collaborative learners light can be shed on how collaborative

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learners distribute roles and activities in AKC and how they can be facilitated to do so in comparison to individual learners who take over all necessary roles and activities themselves. In addition to analysis of group level phenomena (e.g., Weinberger, Stegmann, & Fischer, 2007), zooming in on the individual learner's experiences in collaborative learning arrangements can elucidate how collaborative interaction is related to individual knowledge acquisition (Salomon, 1993; Weinberger, Stegmann, & Fischer, 2008). In the following paragraphs, we will discuss AKC in collaborative and individual online learning environments and its effects on task performance and knowledge acquisition. Subsequently, we present how collaborative learners distribute the task over content-based roles in contrast to individual learners in online learning environments. Finally, we examine how AKC can be facilitated through an argumentative script implemented in the interface of online learning environments.

2. Argumentative knowledge construction in collaborative learning arrangements

In contrast to regular seminar settings, *collaborative learning arrangements*, in which learners in small groups jointly work on learning tasks without teacher interventions (Cohen, 1994) bear possibilities for every student involved to exercise argumentative elaboration activities (cf. Cohen & Lotan, 1995; Hsi & Hoadley, 1997; Van Boxtel, Van der Linden, & Kanselaar, 2000). Collaborative learning has been ascribed added value in comparison to individual learning with regard to fostering both, domain-specific and domain-general knowledge, such as argumentative knowledge (e.g., Johnson & Johnson, 1992). With respect to both types of learning outcomes, collaborative learning has shown to be more effective than individual learning if learners share a goal, positively depend on each other to solve the task, and are individually accountable for their contributions, which could be attained by specific task and incentive structures (Johnson & Johnson, 1992; Slavin, 1993). Collaborative learners depend on each other to a larger degree in complex, open-ended tasks, which consequently have been termed "true group tasks" (Cohen, 1994, p. 3). Explanations for advantages of collaborative over individual learning from complex tasks are often based on the idea that collaborative learners can use their learning partners as an additional resource (Fischer, 2002). Learning partners can be regarded as additional learning resources when contributing unshared prior knowledge to the discussion, which may eventually be shared after learning together and thus, facilitate learners to take over multiple perspectives on the problem (Weinberger et al., 2007).

Beyond sharing and benefitting from each other's knowledge, collaborative learners can mutually elicit argumentative elaboration and thus foster multi-perspective, application-related, transferable as well as argumentative knowledge (e.g., Johnson & Johnson, 1992; Leitão, 2000; Schwarz, Neuman, & Biezuner, 2000). Learning partners may share a focus on a limited range of task aspects and as a collective information processing system put more processing capacity into use when tackling complex tasks (Hinsz, Tindale, & Vollrath, 1997; Kirschner, Paas, & Kirschner, 2009). Kirschner and colleagues (2009), for instance, found an interaction effect between the learning arrangement (individual versus collaborative) and the type of test (retention versus transfer) with respect to efficiency, which was measured by a ratio of effort invested and outcomes in a retention and a transfer test. Results of this study indicate that groups of learners outperform individual learners in efficiency on transfer tests whereas individual learners perform more efficiently on a retention test. These results indicate that group learning has advantages over individual learning from complex tasks regarding acquisition of transferable knowledge. Still, individual learning appears to be superior for efficiently recalling concepts and facts.

Computer-supported collaborative learning (CSCL) scenarios in particular have been argued to facilitate equal participation in argumentative discourse as students could use additional online resources and tools to construct and represent elaborated arguments at their own pace (Andriessen, Baker, & Suthers, 2003; Hsi & Hoadley, 1997; Kirschner, Buckingham Shum, & Carr, 2003; Marttunen & Laurinen, 2001; Munneke, Andriessen, Kanselaar, & Kirschner, 2007; Scardamalia & Bereiter, 1996; Schellens & Valcke, 2006; Veerman, 2003). However, computer-supported collaborative learners frequently suffer from *process losses* when distributing roles and activities in online environments (Strijbos, Martens, Jochems, & Broers, 2004), e.g., because learning partners dominate the debate and block production of arguments (see Meijas, 2007), or have *difficulties to engage in meaningful learning activities* such as constructing arguments and counter-arguments when learning together (Marttunen & Laurinen, 2001). These problems may take different shapes depending on communication modalities, such as synchronicity, code, and anonymity, within specific CSCL environments in contrast to individual online learning (Weinberger & Mandl, 2003).

3. Argumentative knowledge construction in individual learning arrangements

Individual learners in online environments obviously do not suffer from CSCL process losses. Moreover, students have been regarded to be in general more familiar with individual learning environments, in which learners tackle learning tasks and coordinate learning resources in a self-guided manner without teacher interventions (Mandl, Gruber, & Renkl, 1996). Groups of learners often realise a suboptimal distribution of complementary roles, such as the 'sucker' and 'free-rider' (Kerr, 1983), i.e., one learner covering major parts of the task and other learners reducing their task engagement (see also Strijbos & De Laat, 2006). This suboptimal distribution of roles in groups of learners can tremendously reduce the potential of collaborative learning for equal participation in argumentative elaboration activities (Cohen & Lotan, 1995). In contrast, individual learners are supposed to autonomously cover all aspects of a learning task in an active and self-regulated manner and thereby exercise argumentative learning activities at their own pace, without processes losses emerging as in collaborative scenarios.

Possibly, students may be better off to learn how to argue in individual learning environments, as learning to argue does not need to be conceptualised as a genuinely collaborative activity (Kuhn, 1991; Voss & Van Dyke, 2001). A meta-analysis shows that computer support has positive effects on individual writing with respect to quantity and quality of students' essays (Goldberg, Russell, & Cook, 2003). Computer-supported individual essay writing may be also particularly preferable to computer-mediated collaborative writing scenarios, which typically lack the interactivity and expressiveness collaborative learners require to coordinate themselves (e.g., Quinn, Mehan, Levin, & Black, 1983). Research on computer-supported collaborative work (CSCW) likewise shows that computer-mediated groups have difficulties to respond immediately and to convey ideas without using para- and nonverbal social context cues, which might hamper *task performance* of the group, i.e., jointly meeting the solution criteria of a problem (Barile & Durso, 2002; Galegher & Kraut, 1990; Kraut, Galegher, Fish, & Chalfonte, 1992; Tammaro, Mosier, Goodwin, & Spitz, 1997).

Summing up, individual learning arrangements may have specific advantages over collaborative learning – especially regarding recall of concepts and facts – although individual learners cannot

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