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Grounding Support for Effective Collaborative Learning

Lydia HARBARTH[a*], Melanie ERKENS[a] & Daniel BODEMER[a]
[a]*Media-based Knowledge Construction, University of Duisburg-Essen, Germany*
*lydia.harbarth@uni-due.de

Abstract: A common ground of knowledge is the foundation for collaborative learning. However, learners often do not know how to engage in beneficial grounding activities during collaboration, which highlights the need to support such activities and the development of grounding skills. Two prominent forms of support are collaboration scripts and cognitive group awareness tools that pursue different approaches to promoting grounding. While collaboration scripts explicitly ask learners to perform related activities to trigger the exchange of relevant information, cognitive group awareness tools directly provide relevant information about learning partners to implicitly guide learners during learning processes. The present paper examines how the two approaches differ in supporting grounding activities and to what extent they support the development of grounding skills that represent a key qualification of collaborative learning. In the next step of this research project on grounding, the question of how to support the long-term development of grounding skills will be investigated.

Keywords: Grounding, cognitive group awareness tools, collaboration scripts, CSCL

1. The Role of Grounding in Collaborative Learning

Communication and cognitive processes are essential for collaborative learning. Collaboration can be successful when productive interactions between learning partners take place (Dillenbourg, 1999). Such interactions can occur when learners engage in activities like asking questions, giving explanations, elaborating on utterances, or providing arguments (de Vries, Lund, & Baker, 2002), as these activities have proven beneficial building a shared understanding (Roschelle & Teasley, 1995).

For the development of a shared understanding, grounding plays a crucial role. Grounding is the process of constructing and maintaining a common ground, which means a basis of "mutual knowledge, mutual beliefs, and mutual assumptions" (Clark & Brennan, 1991, p. 222). The role of grounding in collaborative learning can be seen as two-fold. Grounding can be a requirement for collaborative learning, i.e., having a basis of shared understanding is necessary to solve the learning task, or grounding can be a part and a result of collaborative learning, i.e., constructing this basis via collaboration (Baker, Hansen, Joiner, & Traum, 1999). For building a shared understanding, learners have to make sure that they are understood by their partners, e.g., by checking for understanding and resolving misunderstandings or misconceptions. If learners do not engage in these grounding activities, collaborative learning might fail. Thus, supporting learners to engage in these activities is necessary. For enabling learners to use these grounding activities in different situations (e.g., at school, university, or work), they further need a grounding skill, i.e., knowledge of a grounding procedure, that allows them to use these activities easily and flexible in different contexts, which highlights the necessity of the development of grounding as a key qualification.

This paper presents the starting point of a research project aiming at the investigation of how grounding in computer-supported collaborative learning (CSCL) can be supported and how grounding skills can be developed. In the following, we present our first discoveries on how different forms of support, collaboration scripts (Kollar, Wecker, & Fischer, 2018) and group awareness tools (Bodemer, Janssen, & Schnaubert, 2018), can support grounding.

2. Support of Grounding

2.1 Collaboration Scripts

Collaboration scripts explicitly guide learners to perform grounding activities, which can also lead to the development of grounding skills. Collaboration scripts structure the interaction during collaborative learning explicitly by guiding learners via activities, roles, and sequences of activities (Kollar et al., 2018). For example, a script prompts learners to engage in specific activities (e.g., "explaining", "providing counter-arguments"), to take specific roles (e.g., "explainer", "counter-argument provider"), and to switch roles after a certain sequence. These activities can be considered on a macro-level of grounding (e.g., "provide an explanation"). On a micro-level of grounding, collaboration scripts have the potential to support more fine-grained grounding activities (e.g., not only prompting to "provide an explanation", but also to "check for (mis)understanding of partner").

Furthermore, (external) collaboration scripts can not only support the execution of activities but also support the development of skills as an internal script (Vogel, Wecker, Kollar, & Fischer, 2017). An internal script is a learner's mental representation of an external script and comprises the knowledge about collaboration processes, also including knowledge about grounding activities. As a result of script use, an external script can become a part of an internal script ("internalization", see Fischer, Kollar, Stegmann, & Wecker, 2013). Such an internal script, which a learner can fall back on, is refined with each new experience during collaboration. For example, it is reconfigured when learners internalize that after providing an argument it is necessary to check for the understanding of the learning partner and to resolve misunderstandings. Briefly, if the execution of grounding activities is prompted by collaboration scripts, potentially, grounding skills (i.e., an internal script of the knowledge about grounding activities) can be developed.

2.2 Cognitive Group Awareness Tools

Another way of supporting grounding is the use of cognitive group awareness tools (cGATs) that increase the awareness of cognitive characteristics of learning partners, e.g., their knowledge, opinions, or assumptions (Bodemer et al., 2018). This information implicitly guides learners during learning processes in different ways (see Bodemer et al., 2018): (1) As a core function, providing information about learning partners supports partner modeling which can facilitate grounding processes between learners (e.g., adapting communication behavior to the knowledge level of a learning partner, see Clark & Murphy, 1982). Further functions of cGAT can support grounding processes additionally: (2) Highlighting of relevant information of the learning material constrains content-relevant communication which helps learners to focus on relevant aspects (e.g., focus grounding activities on topics that require clarification). (3) Presenting information on partner and self enables inter-individual comparisons, which trigger activities to solve socio-cognitive conflicts (e.g., different assumptions between learners highlight the need for the detection and clarification of misunderstandings). (4) Moreover, by collecting and presenting self-information, metacognitive processes can be stimulated (e.g., identifying own misconceptions on a topic). Thus, cGATs have the potential to support grounding by easing the effort of grounding by providing information about the learning partner(s), which otherwise would have been part of an explicit exchange between the learners or the information would not have been exchanged, at all.

Concerning the potential for cGATs to support grounding, more systematic research is needed. First research results underline that learners show more systematic communication behavior when partner information is provided and relevant information is highlighted (Bodemer & Scholvien, 2014). Learners with tool support first discuss conflicting issues and resolve misunderstandings or misconceptions, then proceed to less conflicting aspects, and, in the last step, reassure mutual understanding of initially conflicting issues. In contrast, results also show that learners without partner information proceed rather unsystematically, relying on perceptually relevant (not thematically relevant) information. However, the effect of transferring these grounding activities in terms of a structured proceeding of communication into a next phase of collaboration (grounding skill) could not be observed (Bodemer & Scholvien, 2014).

3. Outlook

This paper presents the work-in-progress status of our research project which aims at investigating the support of grounding during collaborative learning. The driving question is if grounding as a skill – a key qualification – can be developed with the help of tools. Support of grounding can be provided in different ways. In a more explicit way, collaboration scripts can support the execution of grounding activities by prompting these activities. With the help of scripts, not only the execution of grounding skills is possible, but also the development of grounding skills by internalizing externally scripted activities. In a more implicit way, cGATs reduce the effort for grounding by providing information on learning partners and learning material. CGAT prove to be an adequate support of communication and collaboration within a collaborative situation and help learners focusing their attention in complex learning situations (Schnaubert, Heimbuch, Erkens, & Bodemer, 2019). However, beneficial courses of action, as shown when the tool was used, have not been transferred to other similar situations without tool support (Bodemer & Scholvien, 2014). This study only provided partner information for grounding and highlighted information, but did not use information of the learners themselves within the tool, which might additionally support the need for grounding activities. Therefore, it is planned for the next step (and integrated into the work-in-progress poster) to investigate the transfer of grounding activities to other learning situations. Further research questions that will be addressed within the project are how implicit and explicit support methods can be combined in order to support grounding skill development.

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