



Empirical study

Capturing temporal and sequential patterns of self-, co-, and socially shared regulation in the context of collaborative learning



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ARTICLE INFO

Article history:

Available online 3 February 2017

Keywords:

Socially shared regulation
Self-regulated learning
Co-regulation
Collaborative learning
Metacognition
Temporal and sequential analysis

ABSTRACT

This study examined how temporal sequences of regulated learning events, such as types and processes of regulated learning, emerge during different stages of collaborative learning. Earlier research has focused on individual learning and not on the captured temporal sequences of regulation in collaborative learning. The data were collected during a two-month math didactics course taken by teacher education students who collaborated in three member groups. Twenty-two hours of video data were collected to follow how sequences of regulated learning events, along with task execution, emerged within the six groups as their collaboration advanced. The data were analyzed using qualitative content analysis and lag sequential analysis. The results showed that the groups engaged mostly in co-regulated planning and monitoring. Temporal analysis showed that collaborative interactions focusing on task execution promoted socially shared planning, indicating that task execution provided grounding for socially shared planning and regulation to occur. The sequential analysis illustrated that metacognitive monitoring played a facilitative role in the progress of task execution.

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1. Introduction

Asking students to collaborate does not automatically guarantee learning success (Kirschner & Erkens, 2013). Review of empirical results on collaborative learning suggest that the goals of collaboration, namely, to improve understanding and to construct new knowledge, are not easy to achieve (Kuhn, 2015) and that the rarity of true knowledge creation is obvious (Siqin, van Aalst, & Chu, 2015). To succeed in their collaboration, learners need to negotiate and, at least to some degree, determine shared goals regarding what to achieve in their collaboration; plan shared strategies to ensure that goals are achieved; and engage in metacognitive monitoring to keep track of progress (Ku, Tseng, & Akarasriworn, 2013). This means that the focus of collaboration needs to be maintained toward task completion (Malmberg, Järvelä, Järvenoja, & Panadero, 2015), which, in turn, requires that the metacognitive monitoring of the progress of collaboration is shared among the group members (Winne, 2015). This, however, requires that metacognitive monitoring, despite of being individual and internal mental process, will be explicitly shared between the group members.

Metacognition can be shared if group members have similar standards for metacognitive monitoring and if each group member has at least some degree similarity in terms of skillset, which is used when engaging in regulated learning (Winne, 2015). Collaborative learning challenges individual students since each student is responsible for his or her own progress toward task completion. This is to say, individual students need to monitor their own progress toward task completion (Grau & Whitebread, 2012; Hadwin, Järvelä, & Miller, 2011; Hadwin, Järvelä, & Miller, 2017). Yet, collaborative learning does not depend simply on individual students' effort but also on the group's joint efforts to complete the task in agreement (Kempler-Rogat & Linnenbrink-Garcia, 2011; Miller & Hadwin, 2015). When collaborative learning is considered from the self-regulated learning perspective, collaborative learning brings together multiple self-regulating agents (Volet, Vauras, & Salonen, 2009) in which group members engage in monitoring their own progress, their peers' progress and group's progress toward task completion as a whole and share their joint responsibility for the learning process in a shared social system (Roschelle & Teasley, 1995). This suggests that improving understanding and constructing new knowledge in collaborative learning situations cannot be explained using only cognitive processes; metacognitive processes such as metacognitive monitoring processes are critical at the individual and social levels (De Backer, Van Keer, & Valcke, 2014; Greene & Azevedo, 2009).

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Over the last decade, interest in understanding regulated learning, especially in collaboration, has increased (Volet & Vauras, 2013). Three research streams have emerged focusing on the role of regulation in collaborative task engagement (Linnenbrink-Garcia, Rogat, & Koskey, 2011), metacognition in interaction as socially shared (Liskala, Volet, Lehtinen, & Vauras, 2015; Khosa & Volet, 2014; Molenaar & Chiu, 2014), and a view of the processes and types of regulated learning as critical for the success of collaborative learning (Hadwin et al., 2017; Lajoie et al., 2015; Authors, 2016; Authors, 2015). The last stream represents our own interest, which is to understand how individuals coordinate not only their own regulatory activities but also those of their peers and the group as a whole (Miller & Hadwin, 2015).

Hadwin et al. (2011) and Hadwin et al. (2017) maintained that in the context of collaborative learning, three types of regulated learning emerge, self-regulation (SRL), co-regulation (CoRL), and socially shared regulation (SSRL), all of which have been corroborated in an increasing number of empirical findings (e.g., Panadero & Järvelä, 2015; Ucan & Webb, 2015; Zheng & Yu, 2016). Each type of regulation is needed in collaborative learning, but the way the types function varies between the “I perspective,” the “you perspective,” and the “we perspective.” Many studies have detailed the manner in which regulated learning happens in the context of collaboration (e.g., Liskala, Vauras, Lehtinen, & Salonen, 2011; Kempler-Rogat & Linnenbrink-Garcia, 2011; Ucan & Webb, 2015). Typically, researchers focused on regulated learning in collaboration have described how socially shared regulation of learning emerges (e.g., Liskala et al. (2011) and illustrated group-level variations in socially shared regulation of activities (Rogat & Linnenbrink-Garcia, 2011). Researchers have identified and classified episodes, including socially shared metacognitive regulation of learning (Liskala et al., 2011; Khosa & Volet, 2014) and processes of socially shared regulation (Hadwin & Oshige, 2011; Malmberg et al., 2015; Kempler-Rogat & Linnenbrink-Garcia, 2011), and have explicated the role of the individual within the group by identifying forms of regulation, such as self-, co-, and socially shared regulation of learning (Grau & Whitebread, 2012; Ucan & Webb, 2015).

In addition, only a few studies have examined the temporal and sequential aspects of regulated learning (Molenaar & Chiu, 2014; Sonnenberg & Bannert, 2015). These studies emphasized the adaptations learners make during a single learning situation, or across such situations, as a key element of SRL (Hadwin et al., 2017; Johnson, Azevedo, & D’Mello, 2011; Zimmerman & Schunk, 2011). However, adaptations in SRL can be reached only by identifying the temporal and sequential aspects of regulated learning. This means that the way learners engage in self-regulated learning is affected and shaped by their past learning experiences and, therefore, influences the ways learners regulate their learning in the future (Hadwin et al., 2017).

Researchers who investigated collaborative learning have successfully demonstrated that interactive processes, such as negotiating shared understanding and exchanging ideas (Roschelle & Teasley, 1995), are the core processes in knowledge construction. Complementary research focused on regulated learning in social settings has provided evidence that to progress with joint knowledge construction, group members need, at least to some extent, to engage in regulated learning, which is essential for maintaining and overcoming problems in collaborative learning (Järvelä, Järvenoja, Malmberg, Isohätälä, & Sobocinski, 2016). Research focused on regulation in collaborative learning has shown an association between metacognitive monitoring and high-quality knowledge construction (Khosa & Volet, 2014) and the importance of shared planning to initiate working with collaborative tasks (Rogat & Linnenbrink-Garcia, 2011). Despite the increased evidence that shows the benefits of regulated learning for collaborative learning, researchers

have not fully explored how these regulated learning processes occur in temporal and sequential order and how they fuel knowledge construction. Reimann (2009) claimed that the methods employed in regulated learning research neglect the full use of information related to time and order. This is especially problematic when social and collaborative processes are studied in groups that work together for a longer time and progress in collaboration is critical for learning success (Järvelä, Järvenoja et al., 2016). There is a need to consider when and how regulated learning contributes to knowledge construction. This information is essential, especially if it can be channeled back to students “just in time” to prompt a specific regulated learning process that can contribute to knowledge construction.

Temporal and sequential analysis can reveal how sequences of regulated learning unfold over time and can describe the associations between self-, co-, and socially shared regulated learning (Molenaar & Järvelä, 2014). The sequential characteristics of regulated learning show how types and processes of regulated learning typically follow each other while temporal characteristics reveal when types and processes of regulated learning typically occur during the learning session or over time (Reimann, Markauskaite, & Bannert, 2014). The strength of sequential and temporal analysis is its ability to inform when certain types and processes of regulated learning are typically used, as well as the most prominent transitions between types and processes of regulated learning. Azevedo (2014) argued that if regulated learning is considered a cyclical feedback loop, it is important to understand, especially in the context of collaborative learning, how learners engage in various types and processes of regulated learning and, thus, the key types and processes of regulated learning that facilitate collaborative learning.

Thus far, we have identified how SRL processes evolve in individual and collaborative learning within and across learning situations (Malmberg, Järvelä, & Kirschner, 2014; Järvelä, Malmberg, & Koivuniemi, 2016) and how specific regulated learning processes contribute to learning success in the context of collaboration (Malmberg et al., 2015). Still unknown are the meaningful sequences of regulated learning, how they develop over time, and how the temporal and sequential characteristics of regulated learning can inform progress in collaborative learning. In light of these questions, the aim of this study is investigate how the temporal and sequential characteristics of regulated learning can inform progress in collaborative learning.

1.1. Types of regulated learning and their contribution to collaborative learning

Self-regulated learning (SRL) is often characterized as an active and goal-directed process in which learners are portrayed as active intentional regulators of their own cognition, metacognition, motivation, and behavior (Pintrich, 2000; Winne & Hadwin, 1998). When learners self-regulate in the context of collaboration, they are in charge of their individual contributions to the group. For example, in the context of collaboration, SRL reflects each individual’s own contribution toward his or her own learning goals (DiDonato, 2013). Although learners often engage in SRL in the service of group goals, learners do not necessarily make their own SRL explicitly visible to other group members (Miller & Hadwin, 2015). SRL is a mental and metacognitive process; however, in the context of collaborative learning, learners might externalize their SRL while they contribute to joint learning tasks in collaborative interactions (Järvelä, Järvenoja et al., 2016; Järvelä, Malmberg et al., 2016; Järvelä, Kirschner et al., 2016).

Co-regulated learning (CoRL) occurs when learners’ regulatory activities are guided, supported, shaped, or constrained by other members in the group (Hadwin, Järvelä, & Miller, 2011; Hadwin

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