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What is the state of the art in self-, co- and socially shared regulation in CSCL? ☆

Philip H. Winne *

Simon Fraser University, Canada

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ABSTRACT

Articles in this special issue on regulation of learning in computer-supported collaborative learning apply tools across the spectrum of qualitative and quantitative methods to investigate self-, co- and socially shared regulation of learning. As well, a careful consideration of each of these constructs is provided. I briefly review these contributions to identify unique and forward-looking approaches to research in this vibrant area of research. A particular opportunity is recommended for future research regarding the use of process mining, sequence mining, social network analysis and an as-yet to be invented amalgam of these methods in constructing intelligent software agents that could guide participants in CSCL to assemble an optimum mix of self-, co- and socially shared regulation of learning.

1. Introduction

This special issue includes five diverse contributions, each addressing from a different perspective the topic of how learners regulate learning in a group. The collection illustrates a variety of methods in contexts where software supports and constrains what information learners share and how they share it. Amidst an extensive background of research on the more general topic of computer supported collaborative learning (CSCL), these five shine light on matters that I recommend be researched more thoroughly. To set a stage for those recommendations about researching regulated learning and CSCL, I first encapsulate each contribution and select some features they exhibit.

2. Comments on reports in this special issue

Miller and Hadwin (2015) tackle with helpful clarity the central matter of defining forms of regulated activity. They begin with an expansive assertion: Activity in groups is regulated when there is "... intentional, goal directed metacognitive activity in which learners and groups take strategic control of their actions (behavior), thinking (cognitive), and beliefs (motivation, and emotions) in the context of dynamic social interactions" (p. XX). I foreground two features of their claim.

First, consider Miller and Hadwin's definition of socially shared regulated learning (SSRL) as occurring when a "group collectively regulates their thinking, behaviour, motivation, emotions in the joint task" (p. XX, Table 1). For Miller and Hadwin, a task involves a goal, a plan for achieving that goal, skills for working cooperatively and collaboratively, and standards for metacognitively monitoring any or all of these. This begs a question: How does a group transition from a collection of individuals to acting as a collective? Consider three possibilities.

The first possibility is that, before the group is formed, each member of that future group has nearly identical knowledge, motivational stances and emotional connections to a task. In other words, each of the group's members has previously achieved mastery of content, and there are clear and widely shared sociocultural norms and values. In authentic instructional settings and research contexts, the former is improbable. The latter is often assumed but rarely corroborated by data about that particular group and seems improbable when groups are purposively formed to introduce diversity of members' views about the task.

A second path for a group to reach the status of a collective is when one or fewer than all members of a group exercise co-regulation of learning (CoRL). Miller and Hadwin describe CoRL as when "Individual(s) temporarily guide, prompt, nudge and support each other's self-regulation of thinking, behaviour, and beliefs in the joint task" (p. XX, Table 1). In this case, at least some members of a group migrate from a prior state of not belonging to the collective to an initial and perhaps steady state of SSRL. The key parameter that may shape shifts across self-regulated

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* Address: Faculty of Education, Simon Fraser University, Burnaby, British Columbia V3H 4R2, Canada. Tel.: +1 778 782 4858.

E-mail address: winne@sfu.ca

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learning (SRL), CoRL and SSRL is new information that is introduced into the group context by members or via resources that members consult.

An third and important alternative to this second path to forging a collective has become possible as a result of recent research on quasi-intelligent software agents, often realized as an avatar. In this case, new information is introduced to the group not because any member of the group is intentional, strategic, goal-directed or metacognitively attentive. Rather, one or more members of the group recognizes the tactical or strategic value of information introduced by a software agent. What is noteworthy about this case is it affords rigorous experimental control when investigating standards group members use in monitoring information introduced into group work. When new information shifts members' work from individual to shared, this is CoRL triggered by the agent. When the group transforms from cooperative forms of work, where "partners split the work, solve sub-tasks individually and then assemble the partial results into the final output" (Dillenbourg, 1999, p. 8), to collaboration, where "partners do the work 'together'" (Dillenbourg , 1999, p. 8), SSRL is in play.

I note another central feature of Miller and Hadwin's definition of SSRL. It is that metacognition is integral in all three forms of regulated learning. The scope of this claim needs mapping. Metacognition in regulated learning (see Winne, 2011) arises within an individual. It could be a "collective act" under two strict conditions. One is that group members hold identical standards for metacognitive monitoring. The other is overlap of group members' options for exercising metacognitive control; i.e., not every member must have exactly the same set of skills from which to choose in applying metacognitive control to the task or to managing the group, but some members must have some of the same skills. As I previously noted, the likelihood that group members share standards and skills is generally low. To the extent this is true, and given the fact that instances of CoRL and SSRL arise, it suggests researchers should use a lens of metacognition to illuminate the evolution of CoRL and SSRL over time as a group works. Elsewhere, colleagues and I described challenges in measuring features of regulated learning (e.g., Winne, 2010; Winne, Zhou, & Egan, 2011). Software systems that provide a medium for collaborators' work can record comprehensive trace data needed to address some of these challenges. Mapping how metacognition is manifested by members of groups and how groups and their members oscillate across SRL, CoRL and SSRL should be a prime focus in future research. The sorts of systems and tools Miller and Hadwin describe will play key roles in these endeavors, as will approaches applied in the study by Lajoie, Lee, Poitras et al.'s study (2015).

Lajoie and her colleagues (2015) examined the sensitive and challenging task of transmitting bad news of kinds that physicians sometimes must convey to patients. They explored how online collaboration with veteran physicians and medical students unfolded as the latter sought to learn this delicate craft using a synchronous conferencing system. Chat windows were the medium for exchanging comments between students and the facilitator using a problem-based learning protocol when discussing about video episodes showing how a physician communicated bad news. Transcripts of turns (successive contributions to the chat) formed the corpus analyzed after turns were coded to reflect metacognitive activities, co-regulation and socio-emotional interactions. The researchers sought to identify patterns that "represented sensible sequences of metacognitive activities" as a way to open a window onto "metacognitive strategies that contribute to learning" (p. XX).

Lajoie and her colleagues' view of co-regulation requires "purposeful mediation of planning, monitoring, evaluating or changing specific beliefs and strategies for motivation, cognition or behavior" through verbally contributions to the task at hand (p. XX). They note that co-regulatory activities can be productive in two ways: moving the group toward shared goals, or turning the group's focus away from unproductive work and toward a more gainful approach to reaching objectives.

Over two separate sessions, discourse turns were coded as metacognitive if they represented moves for orienting, planning, executing, monitoring, evaluating and elaborating aspects of communicating bad news. Co-regulatory contributions were coded as activating or confirming when they facilitated collaboration, or as slowing or changing if turns inhibited co-regulation. Socio-emotional interactions were coded in several sub-categories nesting under the general division of positive vs. negative socio-emotional interactions.

Lajoie's team applied state-of-the-art data mining algorithms to coded events in the corpus to identify patterns across reciprocating turns that representing co-regulation as "a complex construct that consists of both cognitive and metacognitive activities ... in which multiple group members contribute to the task at hand" (p. XX). In a first stage, they mined codes for sequences in a way that spanned levels of granularity. This afforded stronger representations of context for transitions across three pairings: co-regulatory to metacognitive events, co-regulatory to socio-emotional events, and metacognitive to socio-emotional events. In stage 2 of the analysis, a heat map was constructed to visualize these relationships and aid interpretation.

Within the corpus, discourse changed across sessions and showed patterns within sessions. Metacognition increased over time. The first half of sessions evidenced more orientation and planning while the second half showed more fluid shifts with a greater emphasis on monitoring, evaluating and elaborating. Co-regulation and socio-emotional events were similar in quantity but changed pattern across sessions. Cohesion increased and correlated with fewer change-related co-regulatory moves. Cultivating social presence elevated community.

Heat maps of patterns showed that activating a new but related topic or completely changing topics led to co-regulatory events. In these instances, "group members ease[d] cognitive demands by sharing metacognitive demands" (p. XX). Lajoie and colleagues' analyses demonstrate how advanced quantitative methods can be used to compare discourse to statistically expected likelihoods of occurrence; and how co-regulation manifests as a contextualized social exchange involving a mix of cognitively-, metacognitively- and socio-emotionally-referenced information. These sophisticated interpretations were made possible by the advanced quantitative methods and modern information visualization this team used.

In real life, as well as in research settings, not all group work is productive. Why? Rogat and Adams-Wiggins (2015) approached this question by probing fine-grained features of information that group members introduce into the group's shared environment. They distinguished two forms of CoRL. Each draws differently on a view that group members have limited resources for attending to information. Directive CoRL is characterized when standards for metacognitive monitoring lead to superficial monitoring of whether products meet goals. In directive CoRL, a leader strives to sustain elevated social status and diminish others' contributions to the group's task. Social exchange in directive CoRL disrespects some group members. The consequence is an erosion of group cohesion. In contrast, when CoRL is facilitative, the leader emphasizes standards for metacognitive monitoring that focus on understanding. In the social plane, the leader promotes an inclusive atmosphere for information exchange. This promotes group cohesion and elevates group productivity.

To investigate these relationships, Rogat and Adams-Wiggins analyzed discourse in two small groups of grade 7 students who worked on inquiry-based science tasks. The reseachers purposively

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