# Regulated learning in CSCL: theoretical progress for learning success

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# Regulated Learning in CSCL: Theoretical Progress for Learning Success

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## Summary

Recent theoretical underpinnings of successful computer supported collaborative learning (CSCL) have suggested that it is not only necessary to create environments that allow for learners to work together on complex problems requiring collaboration (i.e., where the benefits of working with others is greater than the transaction costs involved in communicating and coordinating actions; P. Kirschner, Kirschner, & Janssen, 2014), but where the communication and coordination are well regulated.

For collaborative learning to be effective, students must explicate their thoughts, actively participate, discuss and negotiate their views with the other students in their team, coordinate and metacognitively regulate their actions between them (Järvelä & Hadwin, 2013), and share responsibility for both the learning process and the common product (Fransen, Weinberger, & Kirschner, 2013). In collaborating, not only cognitive and metacognitive aspects of subject matter content play an important role, but also the social and meta-social aspects of collaboration (Puntambekar & Hubscher, 2005; Rienties, Tempelaar, Van den Bossche, Gijselaers, & Segers, 2009).

Despite extensive empirical research in CSCL, there is still little research about how groups, and individuals in groups, can be supported to engage in, sustain, and productively regulate collaborative processes. This may be due to overemphasis on developing and testing the functionality and usability of technology-based tools for sharing information or emphasized attention to the content related knowledge co-construction in CSCL. It may be also because of the variety of ways to conceptualize the concept of regulation in CSCL (Järvelä & Hadwin, 2013).

This symposium - an extension of the 2013 Special Issue in Educational Psychologist on the theories underlying CSCL and its use - introduces the ongoing new generation approach to theory building in CSCL; examining and clarifying the role of regulation in collaboration and pushing the discussion further. Papers examine aspects of socially shared regulation, regulative scripting, awareness tools to promote regulation and how multimedia environments can promote regulation. Each paper in the symposium: (a) specifically identifies what is regulated (e.g., task knowledge, own prior knowledge, goals and plans, strategic knowledge, motivation or emotions, etc.) in CSCL, (b) presents empirical findings to show how regulation emerges or influences collaboration, (c) identifies and discusses conditions under which regulation emerges and can be supported, and (d) identifies targets for future research about regulation in CSCL.

Looking at the major problems encountered when using CSCL as pedagogy, one can conclude that many of them might be solved if we would progress in concepts and tools that could help the participants in CSCL groups in the regulation of their working and learning within the group (Järvelä, Kirschner, Panadero, Malmberg, Phielix, Jaspers, Koivuniemi, & Järvenoja, 2014). Being able to strategically regulate one's own learning and that of others is a vital and increasingly important 21st century skill. This includes, for example,

learners' ability to purposefully influence and adjust their own cognitive, motivational, and emotional behaviour as well as that of others for optimal learning and working (Zimmerman & Schunk, 2011).

In the symposium we have four leading research groups in the field of CSCL presenting their recent ideas and advancement of research on CSCL. Järvelä et al. will ground their conceptual advancement in self-regulated learning theory and they review their conceptual progress in (S)SRL research with accompanying CSCL regulation tools and empirical data examples. Fischer and Kollar discuss their Script Theory of Guidance (SToG) and how it provides a framework to explain how observable collaboration processes within a small group of learners is shaped by an interplay of learners' internal and external collaboration scripts. They broaden the framework from schema-theoretical and socio-cultural assumptions to more "social" covering the aspects of social regulation. Janssen et al. discuss their recent advancement in research on awareness in collaboration. They conclude that CSCL environments, and more specifically group awareness tools and supporting tools for teacher, have the potential to enhance students' regulation process. Lajoie et al. examine the theoretical assumptions that best describe the regulatory activities that occur in an on-line problem based learning (PBL) environment. Their introduce computer supported tools fo co-regulation, especially supporting teachers and learners on PBL activities. The two discussants, Kirschner and Hadwin will discuss the papers from two points of view, namely the methodological aspects of the research and the relevance of the research findings for learning and education.

## Socially shared regulation of learning in CSCL: Understanding and prompting individual and group level shared regulatory activities

Sanna Järvelä, Allyson Hadwin, Hanna Järvenoja and Jonna Malmberg

The field of CSCL is progressing, both theoretically and practically (i.e., the design and development of tools and environments). Many successful advances have been achieved, for example, enhancing cognitive performance, stimulating knowledge construction and scripting collaborative interaction processes in CSCL (See Hmelo-Silver et al. 2013). Also less successful results have been received, especially in terms of problems on socio-emotional engagement (Näykki, Järvelä, Kirschner, & Järvenoja, 2014; Rogat & Adams-Wiggins, 2014), pointing out that the role of regulatory processes is critical for a quality of students' engagement collaborative learning settings (Rogat & Linnenbrink-Garcia, 2011; Volet, Vauras, & Salonen, 2009).

Our theoretical definition of regulated learning in CSCL is grounded on self-regulated learning theory, especially the regulation of learning not only with respect to individual processes, but also as social and contextual processes (Hadwin, Järvelä, & Miller, 2011). We argue that to succeed, individuals in groups need skills for regulating themselves (SRL; self-regulated learning), each other (CoRL; co-regulated learning), and together (SSRL; socially shared regulation of learning). Regrettably, many learners lack regulatory skills and struggle to develop them when they work on complex collaborative tasks (Winne, Hadwin, & Perry, 2013). Left on their own, learners often fail to interact productively in groups. For that reason increasing amounts of effort has invested to harness CSCL environments to guide and support regulation and not just knowledge construction (Järvelä & Hadwin, 2013).

In this paper we review our conceptual progress in (S)SRL research with accompanying CSCL regulation tools and empirical data examples. In our research we have been working on empirical studies in real-life learning situations to trace regulated learning in collaborative groups. Our aim has been a) to understand the sequential and contextual aspects of regulated learning (Malmberg, Järvenoja, & Järvelä, 2013), b) to focus on the individual and group level shared regulatory activities (Järvelä, Malmberg & Koivuniemi, 2014) with the help of regulation tools data (Järvenoja, Volet, & Järvelä, 2012), and c) and working for developing technological tools to prompting regulation of collaborative learning (Järvelä et al., 2014).

Our aim has been to capture individual SRL activities as a part of socially shared group level regulation. For that we have tailored and modified technological tools to prompt awareness and externalization of socially shared regulation of learning (AIRE and RADAR) in an individual and group level on-line collaboration S-REG tool extends our previous work by providing targeted support for (S)SRL based on the challenge the groups have identified. Each of these regulation tools prompt students to negotiate and reflect the key SRL processes such as goals, plans and strategies (See Järvelä, Kirschner, Panadero, Malmberg, Phielix, Jaspers, Koivuniemi, & Järvenoja, 2014). Socially shared regulation of learning targets to (meta)cognitive, motivational and emotional processes. Regulation tools make the targets of the individual and social shared regulation visible for the group members and increase possibilities to develop socially shared regulation strategies. Also, these tools offer a new way to achieve data "on-the-fly" processes of socially shared regulation which are not available in other means (Molenaar & Järvelä, 2014).

It is concluded that understanding socially shared regulation of learning often demands understanding the learning context including those situational affordances that provide opportunities for the SSRL and the evolution of social and regulatory processes over time—this is why implementing sequential and temporal aspects in the data analysis is required. Using various technologies for prompting regulatory processes as well collecting data of them can be a new avenue in SRL research and theory building also for CSCL.

## Should the script theory of guidance become more social?

Ingo Kollar, Karsten Stegmann, and Frank Fischer

Based on schema-theoretical and socio-cultural assumptions, the Script Theory of Guidance (SToG; Fischer, Kollar, Stegmann, & Wecker, 2013) provides a useful framework to explain how observable collaboration processes within a small group of learners collaborating in a CSCL environment are shaped by learners' internal collaboration scripts (i.e., memory structures that guide how an individual understands and acts in a collaborative learning situation) and external collaboration scripts (i.e., scaffolds that specify, sequence and distribute learning activities and/or roles among the members of a small group that are designed to regulate collaboration). Yet, SToG has been criticised by Kirschner and Erkens (2013) for being too focused on the individual learner and the interplay of his/her internal collaboration script with a given external collaboration script, whereas the question how the internal collaboration scripts of the single members of a group interact with each other so far remained underspecified. This contribution addresses this criticism by suggesting two paths for a possible extension of SToG:

### Including a differentiation of self-, co-, and shared regulation

The basic SToG assumption is that all members of a group engaging in CSCL come with internal collaboration scripts that shape the way individual learners understand and act during collaboration. So far, SToG mainly focuses on the self-regulation aspect of CSCL, but tends to neglect co- and shared regulation (cf. Järvelä & Hadwin, 2013). An extended SToG needs to offer answers to the question how the activity of one learner activates and regulates the internal scripts of another learner as well as the learning of the group. This leads to the question how to integrate the external regulation through external scripts and participants' individual or group-level regulation through self, co- or shared regulation.

### Situating scripted CSCL in a broader socio-cultural context

The main focus of SToG so far, is to provide a basis for the design of instructional support of individual learners in CSCL. A blind spot, however, is how internal collaboration scripts become socially shared and how external collaboration scripts affect this process. An extended SToG needs to explain how internal collaboration spread within a social community and become a social practice. For future research in this context, it might be promising to identify communities with well-established discourse practices and to investigate whether and how newly introduced discourse practices (e.g., originating from an authority or from a bottom-up process within the community) are able to modify the overall discourse practice within the community. This would certainly necessitate a more long-term perspective for the investigation of discourse processes.

In conclusion, this contribution aims at extending SToG with respect to a stronger conceptualization of the social aspects of CSCL. On the one hand, we propose an extension that focuses on the interplay of the internal scripts of the participating individuals more systematically. On the other hand, we propose paths for future research on how external scripts that introduce and legitimize new social practices within small groups may modify the social practices that are established in larger communities.

## Shared workspaces and multimedia for regulating learning in CSCL

Jeroen Janssen, Femke Kirschner, Anouschka van Leeuwen, Gijsbert Erkens, and Mieke Brekelmans

### Introduction

Collaborative learning, either face-to-face or online supported by technology, requires students to engage in different activities. More specifically, students need to engage in activities in the content space (i.e., discussing task-related concept, problem-solving, etc.; F. Kirschner, Paas, & Kirschner, 2009) of collaboration and the relational space (i.e., maintaining a sound social space, ensuring mutual understanding) of collaboration (e.g., Barron, 2003; Janssen & Bodemer, 2013). Furthermore, activities in both spaces need to be coordinated to ensure effective and efficient collaboration (Janssen, Erkens, & Kirschner, 2011; P. Kirschner, Kirschner, &

Janssen, 2014). This is, however, not an easy task for learners. Computer-supported collaborative learning environments, therefore, often incorporate support and scaffolds that are aimed at supporting and fostering students' regulative capabilities.

Providing these tools, however, does not guarantee that students will be able to regulate their learning processes effectively (P. Kirschner & Erkens, 2013; Rummel & Spada, 2005). This contribution therefore focuses on how student regulation of collaborative learning may be supported by CSCL environments. This contribution outlines how shared workspaces and multimedia environments can be used to support learners' regulative processes. More specifically, we will focus on the concept of group awareness as an antecedent for regulative process and how group awareness tools can support this process. Finally, we examine the role of the teacher in CSCL environments and describe how teachers can contribute to students' regulation of their learning process. We also identify possibilities to support teachers when guiding and scaffolding their students in order to bolster students regulative capabilities.

## Group awareness and group awareness tools

Group awareness has been identified as an important antecedent for effective collaboration (Janssen & Bodemer, 2013). Cognitive group awareness (e.g., information about group members' knowledge and expertise) and social group awareness (e.g., information about group members' contributions to the group process) affects regulation of students activities in the content and relational space of collaboration (P. Kirschner, Kreijns, Phielix, & Fransen, 2014; Kreijns, Kirschner, & Vermeulen, 2013). Group awareness may be enhanced by providing learners with group awareness tools. For example, cognitive group awareness tools may visualize information about students' knowledge regarding a topic (Sangin, Molinari, Nüssli, & Dillenbourg, 2011), whereas social group awareness tools may visualize students' levels of participation (Janssen, Erkens, Kanselaar, & Jaspers, 2007) or enhance the cohesion in the group (F. Kirschner, Slof, & de Kock, in preparation). Research has shown that both cognitive and social group awareness tools can be used by students to regulate their learning process and can enhance the effectiveness of collaboration (cf. Janssen & Bodemer, 2013).

## Teacher regulation of collaborative learning

Recently, there has been a growing interest in the role of the teacher during CSCL (Van Leeuwen, Janssen, Erkens, & Brekelmans, 2013). Teachers for example tend to focus on students' cognitive activities and problems, thus sometimes neglecting the difficulties students sometimes encounter when regulating the learning processes. CSCL environments may therefore also support teachers in diagnosing students' learning problems and intervening adequately. Teachers' interventions may subsequently be used be students to regulate their learning process (Van Leeuwen, Janssen, Erkens, & Brekelmans, 2014). In conclusion, CSCL environments, and more specifically group awareness tools and supporting tools for teacher, have the potential to enhance students' regulation process.

# Computer supported tools for co-regulation: supporting teachers and learners in problem based learning activities

Susanne P. Lajoie, Lila Lee, Eric Poitras, Cindy Hmelo-Silver and Peter Hogaboam

## Theory and rationale

We examine the theoretical assumptions that best describe the regulatory activities that occur in an on-line problem based learning (PBL) environment between medical students and their facilitators who help regulate learning. We start with the guiding framework that PBL is a co-regulatory activity, in which individuals share information, build and construct new knowledge together, but their roles are not totally interdependent. Members acts in their own self-regulating interests, but may participate in socially regulating each other's learning (Volet, Vauras & Salonen, 2009). Co-regulation requires everyone work together to ease the cognitive demands of the task by sharing the metacognitive demands of monitoring, evaluating and regulating task processes (Hadwin & Oshige, 2011; Lajoie & Lu, 2012).

## What is regulated

We explore the role of regulatory processes in a synchronous CSCL designed to support medical students in an international problem based learning environment. The task knowledge involves identifying goals, plans and strategies appropriate for communicating bad news to a patient. Facilitators use a medical acronym, SPIKES (setting, perception, information, knowledge, empathy and strategies and summary) to guide the learning

activity. We examine co-regulation by looking at discourse to examine the role of the facilitators in influencing the metacognitive, co-regulatory and social emotional activities.

## Results

A mixed methods approach was used to analyze the group discourse from 2 PBL sessions. The group consists of 4 medical students (2 from Canada, 2 from Hong Kong, 2 medical facilitators (1 from Canada, 1 from Hong Kong) and an expert facilitator from the US. Metacognitive activities were coded using a modified version of Meijer et al. (2006) codes for orientation, planning, executing, monitoring, evaluation, elaboration. Co-regulation was coded for those that facilitate (activate, confirm) and inhibit (slow, change, stop) group understanding (Iiskala et al., 2011; Hadwin & Oshige, 2011. Social emotional interactions were coded for positive elements (affective, interactive and cohesive elements (Garrison, Anderson & Archer, 2000) as well as negative factors (Rogat & Linnenbrink-Garcia, 2011).

Qualitative analyses revealed the type of regulatory interactions experienced in the PBL. Co-occurring events within the discourse were explored using sequential pattern mining to examine the inter- and intra-relationships between metacognitive activities, co-regulatory episodes and socio-emotional interactions. A strong connection was found between co-regulatory actions that activate discussion and metacognitive acts of planning. The co-regulatory activity of "activate" accounts for 82% of the variance leading to the social-emotional constructs of "contributing to on-going discussion" either moving a discussion forward by showing acceptance of other's ideas or providing additional information. The role of the facilitator is essential in activating learners to pursue their goals. There is a strong inter-relationship (92%) amongst metacognitive activities and socio-emotional interactions with respect to evaluation and interactive social presence, respectively. This result supports research by Järvelä and Hadwin (2013) who show that those who actively participate, discuss and negotiate their views help the overall group coordinate and regulate actions metacognitively .

Adaptive adjustments in the PBL group's thinking was based on continuous metacognitive monitoring and control related to that learning task which can lead to better decisions regarding when, how, and what to regulate (cf. Azevedo et al 2010). The connection between co-regulation and social emotional constructs has implications for instruction. Facilitators can help develop a shared task understanding through simple acts of activating new constructs in line with previous directions introduced earlier.

Future research about regulation in CSCL: More research is needed on the actual content of collaborations and how elements of that content assist in the regulation of learning. Our data reveal some predictability as to the timing and type of facilitator inputs that activate students to peruse goals. The confirmation of the critical role of the facilitator in small group PBL designs can lead to studies that examine coregulation in a larger-scale PBL course. We are designing CSCL tools that will assist facilitators to productively regulate collaborative engagement by providing real-time analysis of student generated content that can notify instructors of key events through a visual dashboard. Analysis will be similar to the first iteration of this research, looking for relationships between the content of dialogue and co-regulatory activity.

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