Computers in Human Behavior 52 (2015) 233–242

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

# Teacher regulation of multiple computer-supported collaborating groups

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ARTICLE INFO

*Article history:*
Available online 18 June 2015

*Keywords:*
Computer-supported collaborative learning (CSCL)
Teaching
Orchestration
Teacher diagnoses
Teacher interventions
Secondary education

ABSTRACT

Teachers regulating groups of students during computer-supported collaborative learning (CSCL) face the challenge of orchestrating their guidance at student, group, and class level. During CSCL, teachers can monitor all student activity and interact with multiple groups at the same time. Not much is known about the way teachers diagnose student progress and decide upon appropriate interventions when they regulate multiple groups synchronously. This explorative study describes the strategies and experiences related to regulating the activities of seven groups of students, as reported by two teachers, and aimed to widen the framework for describing teacher regulation of CSCL settings that are characterized by synchronicity. Recurring themes included the high amount of information load teachers experienced while diagnosing students' needs, the focus and level of regulation, and the way the teachers used prior knowledge of students to decide on an intervention after diagnosis. Both teachers valued the ability to monitor student progress online, and mentioned the necessity of students being able to follow the teacher's activity as well. Theoretical implications are described in terms of understanding teacher regulation, synchronicity, and information load. Practical implications are described for lowering information load.



## 1. Introduction

Computer-supported collaborative learning (CSCL) denotes situations in which students collaborate using information and communication technologies. Collaboration between students is not always successful and it is known that collaborating groups may experience problems, for example when students differ in their motivations (Zhang, Ordóñez de Pablos, & Zhang, 2012) or when social conflicts arise (Kreijns, Kirschner, & Jochems, 2003). Partly, these problems may be reduced by technological support such as visualizations of group work (cf., Xi, Liu, & Ordóñez de Pablos, 2014) or scripting of student activities (Miller & Hadwin, 2015). Increasingly, the role of the teacher in regulating students' activities during CSCL is being recognized (a recent overview is given by Kaendler, Wiedmann, Rummel, & Spada, 2014; see also the Community of Inquiry framework, Garrison & Arbaugh, 2007). For example, teachers can play an important role in stimulating meaningful discussion between students. During CSCL, students often work on tasks that require in-depth discussion of task materials, which means students also construct meaning from the ideas developed during the discussion (Stahl, Koschmann, & Suthers, 2006). The effectiveness of teacher regulation increases when teachers adapt their support responsively to the understanding of the students (Van de Pol, Volman, & Beishuizen, 2010). To do so, one must first determine the students' current level of competence by using diagnostic strategies. When teachers have ascertained students' understanding of the task, they can adapt their intervention to the needs of the groups (Puntambekar & Hübscher, 2005), for example by providing additional explanations during the occurrence of misconceptions (Garrison & Arbaugh, 2007).

While the importance and complexity of teaching in a collaborative setting is recognized, there are still many aspects of the relationship between teaching and learning activities that need further investigation (Garrison, Anderson, & Archer, 2010). One such aspect is the *synchronicity* teachers are faced with when regulating CSCL that stems from the fact that multiple groups of student engage in multiple types of activities at the same time (see Doyle, 2006, for a description of the complexity of events in a classroom). It is known that increasing the size of face-to-face classrooms and increasing the size of collaborating groups (i.e., the number of group members) can negatively influence teaching quality (Blatchford, Baines, Kutnick, & Martin, 2001). However, not much is known about how synchronicity, in terms of the presence of *multiple groups*, affects teacher regulation of collaboration. Given the average class size in secondary education of 25 students, teachers often regulate at least 5 or 6 groups. Few studies have investigated the nature of diagnosis during CSCL and the possible relationship with teachers' interventions (Schwarz & Asterhan,

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http://dx.doi.org/10.1016/j.chb.2015.05.058
0747-5632/

2011). In particular, teachers' experiences with the possibility to regulate multiple groups at the same time and the resulting real-time decisions a teacher has to make, have not been extensively researched. The purpose of this study is to offer an exploration of the challenges a teacher may encounter when regulating multiple collaborating groups in order to enhance our understanding of teaching during CSCL. Descriptions of two teachers are presented to gain insight into teachers' reported strategies and experiences regarding diagnosis, the decision on an intervention after diagnosis, and the intervention itself.

### 1.1. Diagnosing student activities when regulating multiple groups

Teachers can use two strategies to diagnose students' level of understanding, namely by actively questioning students, and by observing students' activities (Van de Pol et al., 2010). In the present study, the computer-supported setting allows the teacher to communicate with students by means of a chat tool. The teacher may perform a diagnosis by directly asking students about cognitive or social aspects of their activities. In contrast to questioning, which requires teacher–student interaction, observing is a non-intrusive way of diagnosing in the sense no such intervening interaction is needed. Unique to a computer-supported setting is that the teacher can access students' activities and task output as it is being constructed. That is, CSCL environments can give the teacher access to the tools that students use to solve the task to diagnose the progress of the task *during* lessons as opposed to the teacher reading students' task output after or between lessons (termed "offline diagnosis" by Smit, Van Eerde, & Bakker, 2013). That is, when teacher and students are online simultaneously, the teacher can see the students' activities in real time, for example by continuous updates in written texts or changes in visual representations of students' arguments (see for example the Argunaut environment; Asterhan & Schwarz, 2010). The teacher can diagnose the way students collaborate by checking student communication in a chat or forum tool, which may provide clues as to how they are collaborating (for example, dividing tasks). This communication may also provide information about cognitive aspects, for example when students correctly apply or explain a concept to a peer.

Of course, the type of information available differs according to the nature of the task and the specific characteristics of the learning environment, but in general, in such settings there is a multitude of information available to the teacher. This *could* make it easier to diagnose the situation. Research in face-to-face settings has shown that it is difficult for teachers to acquire an accurate description of students' understanding (Myhill & Warren, 2005; Rodgers, 2004; Van de Pol et al., 2010). Additional information offered during CSCL settings may therefore be beneficial to the accuracy of teachers' diagnoses by complementing the teacher's observations, thereby helping the teacher to regulate students' learning processes (Cortez, Nussbaum, Woywood, & Aravena, 2009). However, there are two factors that can decrease this accuracy. First of all, the question is whether the teacher has the opportunity to read all the information available to him or her. On the one hand, a teacher could choose to delay answering a question and instead spend time on reading students' contributions. On the other hand, because student and teacher in synchronous settings are online at the same time, students will engage the teacher in conversations, which require immediate responses if the teacher is to make use of this moment (Schwarz & Asterhan, 2011). A consequence might be that teachers' responses to students are adjusted on the fly (Rodgers, 2004) instead of carefully prepared by reading the available information. The second factor is that when a teacher decides to diagnose by reading, the large amount of information could lead to an overload instead of being helpful (Dyckhoff, Zielke, Bültmann, Chatti, & Schroeder, 2012). Thus, the synchronicity in such settings means teachers are faced with a demanding task that requires them to decide how to divide their attention and which group(s) to monitor at a given time.

It is likely that both these concerns are related to the number of groups a teacher is regulating. After all, the presence of more groups means that there are more students who can ask for help, and that there is more information available. Several researchers argue that an increase of information load may prevent deliberate action, thereby possibly hindering conscious diagnosing of student performance (Elliott, 2009; Feldon, 2007). This may mean that in the case of high information load, instead of obtaining and using current information on students' understanding, teachers are more likely to use their existing knowledge about students to make decisions on the appropriate intervention (Feldon, 2007). Schwarz and Asterhan (2011) point out that the possibility to switch between multiple group conversations makes it more difficult to follow and diagnose the development of discussions in a particular group. Moreover, Brühwiler and Blatchford (2011) have shown that teachers more accurately diagnose students' achievement in smaller classes. It is therefore expected that a larger number of groups will lead to teachers reporting a higher information load and less adaptation to students' needs.

### 1.2. Teacher interventions when regulating multiple groups

It was already pointed out there is an intricate relation between diagnosis and intervention (Van de Pol et al., 2010): in order to be adaptive, an intervention should be based on the teacher's diagnosis of students' understanding. This relation would suggest that the difficulties associated with diagnosing, caused in part by the number of groups, also affect the teacher's interventions. Studies into face-to-face class size reduction have indicated that smaller classes lead to more frequent and individualized interaction between teacher and students (Blatchford, Bassett, & Brown, 2011; Smith & Glass, 1980). Teacher interventions were more frequent in small classes both for cognitive and for socially focused interventions. In larger classes, teachers focus more on cognitive activities, in particular activities concerned with planning (Blatchford, 2003).

The results in online settings regarding teacher interventions are not as straightforward as those for face-to-face settings. Russell and Curtis (2013) for example found quantity and quality of teacher interventions were limited in a large online course when compared to a smaller scaled one, while Orellana (2006) found no relationship between online courses' class sizes and the intensity of teacher–student interaction. Furthermore, there are few studies that focus on *collaborative* settings instead of individual student learning. Blatchford et al. (2001) state that smaller collaborating groups of students (i.e., a smaller number of students *per* group) provide the teacher with more opportunity to individualize help, but these authors do not consider the effect of the *number* of groups. The image that arises from studies of non-collaborative settings is that as class size increases, the teacher has less time to spend per student, resulting in less individualized help. This relationship is not as clear in collaborative situations, because students can also turn to each other for help. However, in this case the teacher gains the additional task of focusing on the groups' collaborative process in order to avoid collaborative problems (Kreijns et al., 2003). Thus arises a trade-off between intervening at individual versus small group level (and additionally, at class level). One might expect that larger classes would lead the teacher to intervene more at class or group level, as a solution to the difficulty of reaching every student (Blatchford, 2003). Contrary to this expectation, it was found that "teachers in large classes strive to maintain the same balance of individual, group and whole class teaching as their colleagues in small classes" (p. 589). Again, the question is whether this result is transferrable to an online setting.