A Framework for Small Group Support in Online Collaborative Learning

Combining Collaboration Scripts and Online Tutoring

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Keywords: Computer-supported Collaborative Learning (CSCL), Collaboration Scripts, Online Tutoring, Learning Management System (LMS), Technology-mediated Learning (TML) Model.

Abstract: Many learners experience difficulties engaging in collaborative learning activities online. Computer-supported collaborative learning (CSCL) scripts have been implemented to support online learners. Collaboration scripts have shown much potential in facilitating students' general collaboration skills. However, reported effects of collaboration scripts on domain-specific knowledge acquisition have been less positive. In this paper, I suggest an alternative framework for supporting CSCL learners by combining collaboration scripting and online tutoring. While collaboration scripts can facilitate the acquisition of general collaboration skills, the online tutor is capable of monitoring and assessing small groups' progress and providing them with suitable content-specific prompts. The role of the online tutor is also important in terms of establishing social presence in the online learning environment. In order to develop the conceptual framework, I present experiences from an online collaborative learning course. I support the discussion by student insights collected through surveys and a focus group interview.

1 INTRODUCTION

Collaborative learning is a result of a continued attempt to reach and maintain a shared understanding of a concept (Roschelle and Teasley, 1995). Collaboration may happen spontaneously, but usually this is not the case (Strijbos, Martens, and Jochems, 2004). Lack of prior knowledge about collaboration makes it challenging for students to engage in crucial processes of an effective collaboration setting (Fischer et al., 2013).

In addition to predicting the interaction and impact of multiple factors in a computer-supported collaborative learning (CSCL) environment, researchers attempt to directly influence the flow of collaborative learning (Dillenbourg, 2002), by providing specific support. Kopp et al., (2012) specify that there are two methods to support online collaborative activities: providing certain structures in the learning environments or moderating the collaborative learning process during the process itself. An example of the former is CSCL scripts, and of the latter – online tutoring. Collaboration scripting has shown much potential in facilitating interactions among learners. However, there is a number of unsolved challenges in relation to the design and implementation of collaboration scripts.

This paper presents a framework for small group support in CSCL contexts that combines CSCL scripting and online tutoring.

The paper reports on 2,5 years of experience from a tutor-supported online collaborative learning course. The paper presents a holistic view of the CSCL environment created, and discusses how the learner support functions in this. The discussion is complemented with data collected through student surveys and interviews. Thus, the paper seeks to address the following question: How can CSCL scripting and online tutoring be combined to provide small groups with support for cognitive, meta-cognitive, and social processes?

The paper is structured as follows. The next section discusses related literature, followed by an outline of the methods applied for the empirical research. Next, the experiences from the online collaborative learning course are presented. The preliminary framework for learner support is discussed. The final section presents conclusions and implications for future research.

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2 RELATED RESEARCH

A collaboration script is a "set of instructions prescribing how students should form groups, how they should interact and collaborate and how they should solve the problem" (Dillenbourg, 2002, p. 61). A variety of collaboration scripts and their key functions have been discussed in the literature (Dillenbourg, 2002; Kobbe et al., 2007; Kollar et al., 2006; Weinberger, 2011). Collaboration scripts can be introduced in both face-to-face and computer-mediated conditions ("CSCL scripts").

A recent meta-analysis by Vogel et al., (2016) demonstrates that collaboration scripts have a strong positive effect on collaboration skills, but a small effect on domain-specific knowledge acquisition. Studies have reported on absent or even negative effects of scripting on domain-specific knowledge acquisition (Stegmann et al., 2007; Weinberger et al., 2005). It has been demonstrated how a script can limit learners' reflective thinking (Weinberger et al., 2005). Providing too much structure can also lead to learners choosing not to follow the script due to the cognitive load (Popov et al., 2014).

Instead of imposing a lot of structure on learners' activities, scripts can be particularly effective when they promote knowledge about argumentation (Noroozi et al., 2013).

The effectiveness of collaboration scripts has also been found to depend on learners' internal scripts, that is, their prior knowledge on collaboration (Kollar et al., 2006; Kollar et al., 2007). The adaptive way of scripting has been discussed as the optimal solution – fading the script out over time or providing scripting only when necessary (Rummel et al., 2009). Fading would be optimal in case it is "adapted to the learner's current state of development of internal script components" (Fischer et al., 2013, p. 63). Therefore, in order to provide an adequate level of scaffolding, it is necessary to evaluate learners' current needs.

Online tutoring is another way to provide support to online students. Normally, tutors do not really teach; instead, they guide students through the activities planned by the course teacher (Goold et al., 2010).

Berge (1995) categorizes a tutor's tasks into *pedagogical*, *social*, *managerial* and *technical*. Kopp et al., (2012) mention three large groups of collaborative learning activities which need to be supported by the online tutors: *content-specific cognitive activities*, *social activities*, and *meta-cognitive activities*. These classifications can be viewed together (see Table 1).

In this paper, I aim to explore the potential of combining collaboration scripts and online tutoring in order to ensure sufficient and adaptive support for CSCL learners.

Table 1: Roles of the online tutor aimed at supporting content-specific cognitive, social and meta-cognitive collaborative learning activities.

Role (Berge, 1995)	Supported processes (Kopp et al., 2012)	Examples
Pedagogical	Content-specific cognitive	Monitor progress; provide feedback and prompts
Social	Social	Promote open and inclusive learning environment
Managerial	Meta-cognitive	Help students plan and coordinate activities
Technical		

3 METHOD

In order to develop a conceptual framework for small group support in a CSCL environment, I discuss observations from an online collaborative learning course through the lens of the technology-mediated learning (TML) model (Gupta and Bostrom, 2009). I support the discussion by insights from student surveys and a focus group interview.

3.1 Course and Participants

The context is a one-year postgraduate online collaborative learning course run by a Norwegian university. The course focuses on online pedagogy and design of online courses. By February 2017, two cohorts have completed the course (N=54) and the third cohort (N=24) is currently taking the course. The course is international and has involved participants from Europe, central Africa, Asia, and Latin America. Educational background and age of the participants also vary. As the course is targeted at specific groups in partner universities, some of the participants may be familiar with each other before starting the course. In addition, there is a one-day face-to-face kick-off session organized locally for groups located in Norway and central Africa.

The scope of the course is 20 ECTS credits. Students are assigned in small (5-6 members) cross-cultural groups where they work throughout the semester. The first cohort was not facilitated by the online tutor. The online tutor support was introduced in the second round of the course, and the author of

the paper has been involved in this role up to the present moment. Implementation of collaboration scripts in the course is discussed in Section 4.3.2.

The main learning platform is a university learning management system (LMS) with standard functionality.

3.2 Student Perspective

In this paper student insights are used in order to build a comprehensive framework for learner support in CSCL. Student insights were collected from representatives of all three cohorts:

- Student survey of the 2nd cohort administered in the end of fall semester 2015 (N=14);
- Focus group interview with African participants from the 1st and 2nd cohorts carried out in the end of spring semester 2016 (N=14);
- Student survey of the 3rd cohort administered at the start of spring semester 2017 (N=9).

Selected excerpts from the surveys and the interview are included in the paper in order to complement the observations.

3.3 TML Model

The experiences from the online collaborative course and the results of the empirical data collection are presented based on the TML model (Gupta and Bostrom, 2009). The model is based on two premises. First, external structures are designed to reflect the spirit of the system (i.e., the specific way of how the participants are expected to act). Second, the participants (i.e., learners) interact with the system and adapt its features according to their interpretation of the spirit. Importantly, the TML model focuses on the learning process, during which the students are expected to appropriate the structures.

The model is used in the paper as a lens for understanding the interplay of core elements in a CSCL environment holistically. In the next section, I discuss each of these elements, following the propositions of the TML model and referring to the experiences from our course. Most attention is focused around the learning process and support mechanisms integrated in this (see Figure 1).

4 EXPERIENCES FROM THE COURSE

4.1 Spirit

The spirit of the system is driven by the *learning goals* and *epistemological perspectives* (Gupta and Bostrom, 2009). The epistemological perspective of the collaborative learning course discussed in the paper is socio-constructivist, where learners are active in advancing their knowledge through the shared processes of discussion and argumentation. Meta-cognitive learning goals become as important as cognitive goals, since students are expected to learn to reflect, question and argument in addition to obtaining content-specific knowledge.

4.2 Learning Method Structures

The structures are implemented in the learning method dimension, which includes the aspects of *information technology*, *learning techniques* and *team* (Gupta and Bostrom, 2009).

4.2.1 Information Technology

Jeong and Hmelo-Silver (2016) have identified seven core affordances of technology to support collaborative learning. Collaborative technologies should allow students to (1) engage in a joint task, (2) communicate, (3) share resources, (4) engage in productive collaborative learning processes, (5) engage in co-construction, (6) monitor and regulate collaborative learning, and (7) find and build groups and communities.

The LMS has proved to be an appropriate technology for online collaboration. Students actively use the platform to work collaboratively. All discussions in the LMS run asynchronously by means of text. The asynchronous mode of communication ensures flexibility for students from different parts of the world to participate, which is crucial in this context. Moreover, asynchronous discussions make learning visible and help students reflect (Serçe et al., 2011).

However, some student feedback has also suggested that synchronous channels for communication need to be provided to some extent: "*We never had a clear time we could discuss more synchronously*" (survey of the 2nd cohort).

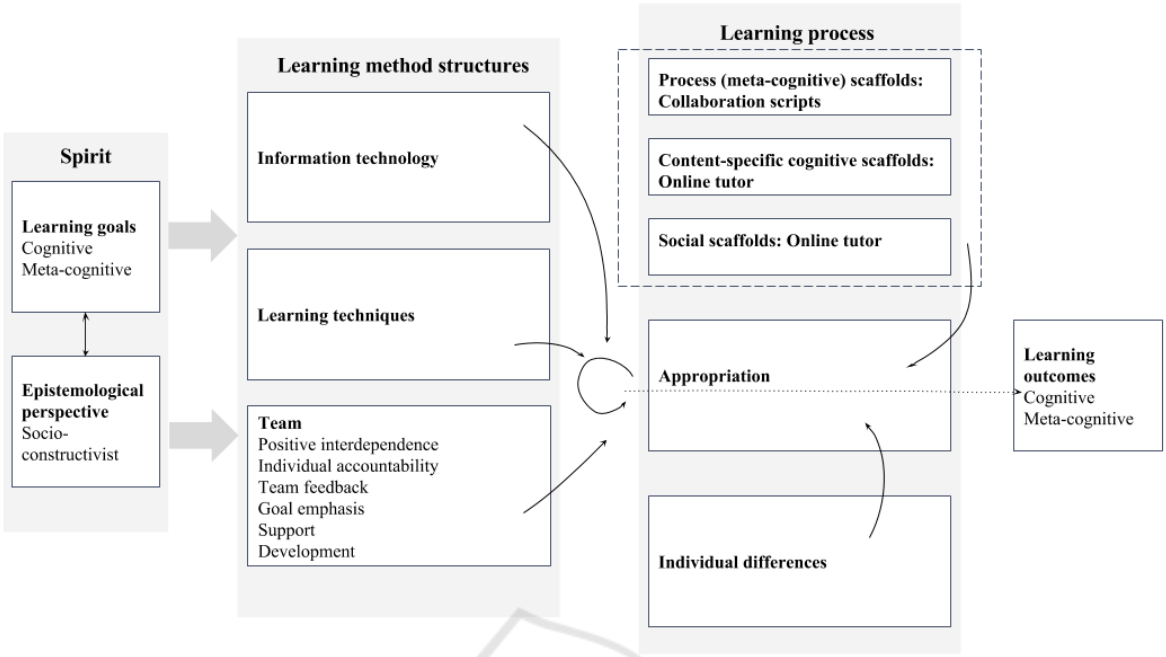

Figure 1: Small group support framework (dashed line) in the context of the TML model (Gupta and Bostrom, 2009).

4.2.2 Learning Techniques

CSCL courses often deal with fuzzy learning techniques which encourage the learners to explore, discuss and negotiate with each other, which is also the case in the course discussed in this paper. Constructing meaningful tasks having variant solutions is crucial for learners to have a productive collaborative discussion.

4.2.3 Team

The team dimension in the TML model includes several components which are especially important in collaborative learning.

Positive interdependence refers to each group member not being able to succeed unless the other team members succeed. This way, each peer's contribution benefits the rest of the group (and vice versa) (Kreijns et al., 2003). I have observed that positive interdependence may not have been promoted sufficiently in our course environment, as a large part of the assessed work is done individually.

Individual accountability refers to each of the group members being responsible for doing his or her share of the common task (Kreijns et al., 2003). One of the problems in the CSCL context is that the external observer (i.e., tutor) does not always have the full overview of the group's activity. While it is possible to provide feedback to the group, identifying the contribution of individual participants becomes challenging.

Team feedback refers to students reflecting on how well the team is performing (Gupta and Bostrom, 2009). In the course discussed in this paper, participants are encouraged to share reflections after completion of each module on their group's forum. These reflections concern individual and group learning processes.

Goal emphasis refers to students focusing on accomplishing team goals (Gupta and Bostrom, 2009). An effective strategy used in this course is the "group contract" which students are required to agree upon in the beginning of the process. A standard template of the contract can guide students in specifying the aspects necessary for successful collaboration. Goal emphasis is crucial for students in building a common ground before starting the collaborative process. Students commented on the usefulness of the group contract in the surveys and interview, for example, "*The group contract that we made at the beginning of the course helped us to work together*" (survey of the 2nd cohort).

The *support* and *development* refer to promoting students' understanding and sustaining effective interactions respectively (Gupta and Bostrom, 2009). In collaborative learning, students prompt each other and build on each other's understanding in order to advance their knowledge. In addition to acquiring

content-specific knowledge, students need to be able to argument, discuss and negotiate. While some of the participants may have more advanced collaboration skills, other members may require more support and scaffolding. I focus on the support techniques in the next section.

4.3 Learning Process

During the learning process students are expected to actually appropriate the learning method structures. According to the TML model, learning process includes *appropriation*, *process scaffolds*, and *individual differences* (Gupta and Bostrom, 2009). I complement the framework with *content-specific cognitive scaffolds* and *social scaffolds*.

4.3.1 Appropriation

If structures are well-designed, better appropriation is expected to lead to better learning outcomes (Gupta and Bostrom, 2009).

In this course, the structures have generally been appropriated the way it was expected. Student groups settle with the shared understanding of how the tools are to be used. However, the results of the focus group interview reveal that students sometimes had to switch to alternative communication channels due to the access issues.

Moreover, the focus group interview revealed that a significant number of participants had felt uncomfortable as they had experienced challenges when navigating in the LMS in the beginning of the course. These participants confessed that if not for the help of their peers and tutors, they would have most likely given up at the early stages of the course.

4.3.2 Process Scaffolds

If the learning method has well-designed structures, scaffolds will influence the faithfulness of learning method appropriation. According to the TML model, appropriation of the learning method structures is facilitated by the *meta-cognitive* (i.e., promoting individual reflection on learning), *procedural* (i.e., promoting effective use of available resources and tools), and *strategic* (i.e., helping students plan and analyze) scaffolds (Gupta and Bostrom, 2009).

I have observed that scaffolding is important on both macro (i.e., the course) and micro (i.e., the task) levels. In this course, scaffolding on the macro level is implemented through a detailed overview of the course structure. Such scaffolding fosters students' awareness as they have a clear idea of how the roles will be rotated and activities distributed throughout the course (Weinberger, 2011). Tutorials on the use of the tools are provided in the course environment.

Scaffolding on the task level was not provided for the first two cohorts. I then observed that participation in the beginning of the course was rather limited as students seemed insecure about the necessary steps to be taken and their timing. It also took time for the tutor to evaluate students' levels of participation to provide prompts. Moreover, throughout the course students often spent too much time (even with tutor's intervention) on specifying their course of action. The collaboration scripts were implemented in selected activities for the latest cohort. Collaboration scripts facilitated role division, and students generated more questions to peers aimed at building shared understanding of concepts. In addition, they had a clearer course of action and the overall amount of coordination was reduced.

4.3.3 Content-specific Cognitive Scaffolds

In the survey of the 2nd cohort, the students were asked to rank the four roles of the online tutor (Berge, 1995) in order of importance for them (see Figure 2).

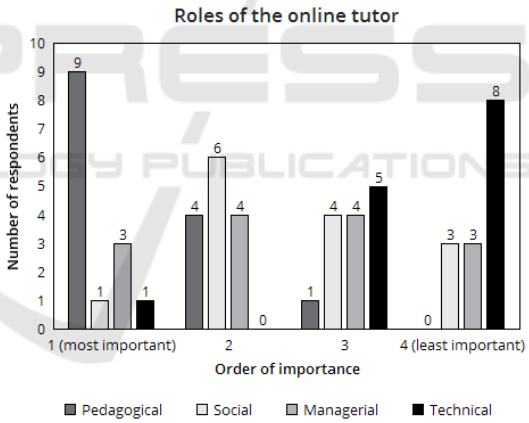

Figure 2: Roles of the online tutor ranked by students.

The pedagogical role was considered most important, which emphasizes the importance of tutor participation in the process of content-specific knowledge acquisition.

In addition, students from the 2nd cohort were also asked to choose from one to five specific functions of the online tutor which they experienced as most beneficial for them (also the "other" option was provided, but was not chosen) (see Table 2). The most frequently chosen options demonstrate that students especially appreciated the pedagogical and managerial role of the tutor.

Table 2: Students' responses about tutor's functions ("P" – Pedagogical, "S" – Social, "M" – Managerial, "T" – Technical).

Functions	Role	N
Explaining aspects of the course content	P	9
Providing additional materials	P	8
Pointing out the areas for improvement	P	7
Providing feedback after the task completion	P	7
Providing guiding questions	P	4
Providing individual support	P	2
Encouraging your participation	S	6
Acknowledging your work	S	3
Promoting social interactions	S	2
Helping to handle conflicts in the group	S	0
Guiding you through the course structure and assignment requirements	M	9
Reminding you of the deadlines	M	2
Helping you to use the technology	T	1

Too much tutor intervention may result in students only addressing the tutor's requests instead of developing their own line of discussion (An et al., 2009). I have observed students having different opinions about the frequency of tutor's interventions. For example, the survey of the 3rd cohort suggests that the cohort is somewhat less dependent on the online tutor's involvement (possibly due to a higher number of students having experience in online collaborative learning).

4.3.4 Social Scaffolds

Reflecting on earlier research (Kopp et al., 2012; Remesal and Colomina, 2013; Sung and Mayer, 2012), it is crucial to include social processes as one of the learning process dimensions in CSCL. Learners should be able to share opinions freely in order to relate to and benefit from each other's knowledge. Online tutoring has been demonstrated to be able to promote social presence (Lazareva, 2017; Sung and Mayer, 2012).

Generally, the students perceive the course environment as open and supportive: "*I felt that my views were never ridiculed at any time, so it made me free to say whatever I wanted to say*" (survey of the 2nd cohort); "*[…] all members were very courteous and civil to one another*" (survey of the 3rd cohort). However, it was also mentioned that there was little personal communication in the platform: "*My group interactions were strictly on the academic discussions we were meant to handle. There was very little sharing of personal experiences and it was too little for me to learn about my peers or my tutor*" (survey of the 2nd cohort).

4.4 Individual Differences

Last but not least, it is important to mention that individual differences can influence learning outcomes by affecting the faithfulness of learning method appropriation (Gupta and Bostrom, 2009). Although multiple aspects can be discussed in this section, I will underline two of them: (1) cultural background and (2) previous experience in online collaborative learning.

Generally, students have been reporting positive experiences regarding the cross-cultural collaboration as they have perceived it as enriching. However, some of the students have reported on differences in approaching the tasks, for example: "*[…] while we would initiate a conversation about a topic by conveying our own thoughts and feelings on a subject, very often they would write a big article about the subject where they talk about the views of other people on this subject, complete with a list of references*" (survey of the 3rd cohort).

I have also observed how differences among students in terms of experience in online collaborative learning have influenced the quantity and quality of participation in discussion forums. Naturally, experienced learners are more proactive and master the features of the LMS more efficiently.

5 DISCUSSION

5.1 Outlining the Framework

Synthesizing research on online tutoring and CSCL scripting and complementing it with our experiences from running an online collaborative learning course made it possible to suggest a framework for small group support in the CSCL setting (see Figure 1). The framework addresses facilitation of content-specific cognitive, meta-cognitive and social learning processes in students. The TML model (Gupta and Bostrom, 2009) used as a lens to develop the framework considers the interplay of crucial dimensions in a CSCL environment as a whole. It is important to ensure that all the elements are present. If not, this may impede the collaborative learning process in ways that cannot be effectively addressed by the online tutor or collaboration scripts.

Meta-cognitive learning processes can be facilitated by CSCL scripts. Instruction by scripts implies specific behavior from students. The scripts here make concrete prompts on how to act and take care of role rotation to ensure equal participation. Scripts also help students reduce process losses by

grouping them, distributing tasks among the group members and setting the time frames. Too much effort paid to the coordination activities may impede the socio-cognitive processes (Weinberger, 2011). Scripts decrease students' uncertainty about the organization of the course in general, procedures in separate tasks and use of the tools.

However, as Vogel et al., (2016) discuss, students acquire effective collaborative learning skills when they are *repeatedly* supported by scripts so that they have time to internalize effective strategies.

Content-specific cognitive processes can be scaffolded by the online tutor. Students' different opinions on the amount of tutor interventions underline the importance of support being adaptive. It is vital for the tutor to monitor how much support students need to provide appropriate scaffolding.

A positive social atmosphere is an important aspect in effective CSCL, which should not be taken for granted. In online environments students may experience lack of social connection with each other due to the text-based nature of communication (Sung and Mayer, 2012). The online tutor can help students avoid the feeling of loneliness in an online environment (Kopp et al., 2012). The social role of the tutor is therefore included into the framework.

Relatively small amount of survey and interview respondents is the main limitation of this paper. However, I have considered student reflections from each of the three cohorts to create a wider picture of the course design, its advantages and drawbacks.

5.2 Implications for Further Improvement of the CSCL Environment

Reporting on the course experiences through the TML model makes it possible to reflect on implications for further improvement:

- Complementing the asynchronous learning environment with opportunities for synchronous communication may be beneficial. This would also facilitate more off-task interactions (Serçe et al., 2011);
- More emphasis should be put on the group dimensions (as opposed to individual) in order to enhance positive interdependence;
- Implementing peer assessment techniques may be helpful in order to ensure individual accountability;
- Implementing collaboration scripts should start from the very beginning of the course and allow students to gradually internalize the effective strategies.

Moreover, the role of peers and tutors should not be underestimated in the beginning of the course when the online environment is being introduced. Many novice participants may require additional guidance.

6 CONCLUDING REMARKS

The paper has discussed an approach for combining collaboration scripting and online tutoring in the overall design of a CSCL course in order to ensure support for learning processes in small groups. This approach is transferable to similar contexts and does not require specific software for its implementation.

The discussion also signals several areas where work remains to be done, such as facilitating collaborative interactions across cultures and developing assessment techniques that would ensure positive interdependence and individual accountability.

It has previously been questioned whether experienced tutors develop their approach based on daily practice or whether they have a theoretical basis for more profound reflection (Kopp et al., 2012). Developing a more systematic view on providing content-specific and social scaffolds is important in order to introduce concrete guidelines for online tutors. In the same way, future research should look into guidelines for educators in terms of designing collaboration scripts to support meta-cognitive learning processes in small groups.

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