

Facilitating Student Engagement in the Context of Computer-Supported Collaborative Learning

Aleksandra Lazareva

**Facilitating Student Engagement in the
Context of Computer-Supported
Collaborative Learning**

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List of Abbreviations

ADILA	Agder Digital Learning Arena
CE	Collaboration Engineering
CSCL	Computer-Supported Collaborative Learning
GSS	Group Support Systems
IA	Interaction Analysis
ICT	Information and Communication Technologies
IS	Information Systems
LMS	Learning Management System
TML	Technology-Mediated Learning

Abstract

Computer-supported collaborative learning (CSCL) is an established area of research focusing on practices of meaning making and knowledge building facilitated by technological tools (Resta & Laferrière, 2007; Stahl, Koschmann, & Suthers, 2006). CSCL provides students with multiple opportunities for active knowledge construction that are often not available in a traditional classroom setting. However, it should not be taken for granted that learners engage in productive collaborative interactions once they are introduced to the learning environment, assigned in groups, and provided with a learning task. In fact, many learners experience motivational and cognitive challenges when engaging in CSCL. In addition to not knowing how to coordinate group activity and proceed with the task (Fischer, Kollar, Stegmann, & Wecker, 2013), students may experience challenges related to the psychological dimension of social interaction. From this point of view, helping students establish a feeling of online community is crucial for group dynamics (Kreijns, Kirschner, & Jochems, 2003; Popov, Leeuwen, & Buis, 2017).

This thesis employs the concept of student engagement (Fredricks, Blumenfeld, & Paris, 2004) that identifies several vital dimensions that need to be facilitated in the context of CSCL. Student behavioral engagement should be facilitated through explicit opportunities to participate in the learning process. An open and inclusive learning environment is a crucial precondition for emotional engagement. Finally, cognitive engagement should be prompted in order to help students actively engage in the process of knowledge co-construction. The main research question (RQ) is formulated as follows:

How can students' behavioral, emotional, and cognitive engagement be supported in the context of computer-supported collaborative learning (CSCL)?

This thesis explores effective strategies to facilitate student engagement in the context of CSCL. The discussion centers around online tutoring and collaboration scripting for fostering an inclusive online learning environment and effective student interactions. Since this research was mainly carried out in an asynchronous setting, the implications of the asynchronous mode of interaction for collaborative learning are explicitly addressed.

To answer the main RQ, the thesis addresses three sub-questions (SQ):

- SQ1: How does the asynchronous mode of interaction affect the process of online collaborative learning in the context of a university course?

- SQ2: How can the online tutor contribute to building an inclusive online learning environment and promoting effective collaborative interactions among students in the context of a university course?
- SQ3: How can collaboration scripts promote effective online collaborative interactions among students in the context of a university course?

The research conducted in this dissertation is cross-disciplinary and combines the CSCL and information systems (IS) perspectives. To address the multidimensional concept of student engagement, three theoretical frameworks are employed. The theory of affordances (Hutchby, 2001; Jeong & Hmelo-Silver, 2016; Pozzi, Pigni, & Vitari, 2014; Suthers, 2006; Van Osch & Mendelson, 2011) is employed to understand how lack of synchronicity may affect student interactions and involvement in the learning activities. The theory of social presence (Gunawardena, 1995; Kopp, Matteucci, & Tomasetto, 2012) contributes to the discussion of building an open and inclusive online learning environment. Finally, the research on collaboration scripts (Fischer, Kollar, Stegmann, & Wecker, 2013; Vogel, Wecker, Kollar, & Fischer, 2016) is used to understand the mechanisms that help to trigger effective learning interactions among collaborating students.

This research is part of the Agder Digital Learning Arena (ADILA) program at the University of Agder, and the data were collected in courses at the Bachelor's and Master's degree level in the university. For most of the course activities studied, the university learning management system (LMS; Fronter) was used as the platform for group collaboration. In addition, one study was carried out using Google Docs as a tool for synchronous collaborative writing.

The research project aims at understanding group learning processes unfolding over time as groups establish their norms and routines, rather than focusing on individual learning in the group context (e.g., through pre- and post-tests). The project follows a sequential multimethod research design, with the results from the methods applied feeding into each other (Mingers, 2001). The data were collected through observations of online collaborative learning in a student group, one student focus group interview, nine individual student interviews, two student surveys, and two experimental setups. Interaction analysis (IA; Jordan & Henderson, 1995) and qualitative content analysis (Elo & Kyngäs, 2007; Hsieh & Shannon, 2005) were employed to analyze the data.

The findings suggest that the asynchronous mode of interaction makes students perceive the learning environment as impersonal. The asynchronous LMS platform provided limited opportunities for off-task interaction and students getting to know each other. In addition, students often felt that their text was misinterpreted by their peers. This suggests that the asynchronous platform should be complemented with synchronous tools to provide students with more opportunities for social off-task interactions. Moreover, some students developed a habit of posting lengthy contributions not related to earlier inputs by their peers. By contrast, employing a synchronous platform for collaboration proved to be helpful for the students to effectively keep their joint attention on the task. However, this did not necessarily imply that their interactions were transactive, which is in line with recent research (Popov et al., 2017). This suggests that the transactivity of student discussions should be supported by collaboration scripts whether or not the learning platform is synchronous.

The role of the online tutor was found to be instrumental in establishing a feeling of social presence in an asynchronous collaborative learning environment. Promoting an open and inclusive environment is important not only from the point of view of emotional engagement but also cognitive engagement. Students need to feel secure and encouraged to participate in order to actively share and argument for their opinions and express criticism. Here, the role of the online tutor is also important in providing students with domain-specific scaffolds such as hints and guiding questions.

Collaboration scripts were found to increase the overall level of activity as scripted groups produced more contributions than students in the unscripted condition. At the same time, providing too much detail in the script can result in information overload, which can make students skip parts of the script. Therefore, collaboration scripts should be formulated clearly and concisely. For example, scripting student roles in the group proved an effective way of promoting the transactivity of student discussions. Moreover, the findings of this research project suggest that it is optimal to combine collaboration scripting with online tutoring. While collaboration scripts should mainly target students' general collaboration skills, the online tutor's input should target students' domain-specific knowledge. The role of the online tutor is also vital in the process of script implementation, monitoring its effects, and adjusting, phasing out, or terminating the script.

The results of the project provide a range of practical, theoretical, and methodological contributions. From the practical point of view, the dissertation presents a number of guidelines for educators aimed to support students' behavioral, emotional, and cognitive engagement in online collaborative learning. This includes suggestions on combining the collaboration scripting approach with online tutoring. The main theoretical contribution lies in combining the theoretical perspectives of affordances, social presence, and collaboration scripts to approach the concept of student engagement in a comprehensive manner, rather than focusing on individual dimensions. Highlighting the possible cross-fertilization of these perspectives may also contribute to their further development and refinement. Moreover, the application of these theories together demonstrates that CSCL and IS share several focal areas of interest when it comes to effective online group facilitation practices, thus contributing to bridge the gap between these two domains. Thus, one of the theoretical contributions of this project is the identified potential synergies between collaboration engineering (CE; de Vreede, Briggs, & Massey, 2009) and collaboration scripting. Finally, the project also suggests a methodological contribution. The studies on collaboration scripting build on earlier frameworks for qualitative content analysis (Curtis & Lawson, 2001; Gunawardena, Lowe, & Anderson, 1997; Hull & Saxon, 2009) and suggest further refinement of the formulated categories in these frameworks.

The findings of this research suggest several areas for future research. Applying different theoretical perspectives to approach student engagement in CSCL could uncover aspects that have not been discussed before and contribute to cross-field theorizing and research. The learners' cultural background may be an important factor to consider for explaining issues of group dynamics. Moreover, further research is needed on the role of social networking tools in combination with traditional learning platforms, which is especially relevant in online contexts where the learners do not have the opportunity to meet face-to-face. Finally, more research is needed on the role of the online tutor in implementing collaboration scripts, monitoring their effects, and phasing out or terminating them.

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1 Introduction

Collaborative learning is an educational practice where interactions among peers constitute the most important aspect of learning (Dillenbourg, Järvelä, & Fischer, 2009; Kreijns, Kirschner, & Jochems, 2003; Stahl, Koschmann, & Suthers, 2006). Collaborative learning implies active knowledge construction, and students are expected to engage in acquiring, generating, and analyzing information through the exchange of multiple ideas and feedback (Alavi, 1994; Leidner & Fuller, 1997; Neufeld & Haggerty, 2001). Students need to keep challenging each other's contributions and checking their outcomes for correctness (Popov, Leeuwen, & Buis, 2017).

The central focus of computer-supported collaborative learning (CSCL) is on practices of joint meaning-making mediated through technological artifacts (Stahl et al., 2006). CSCL has been established as a “dynamic, interdisciplinary, and international field of research focused on how technology can facilitate the sharing and creation of knowledge and expertise through peer interaction and group learning processes” (Resta & Laferrière, 2007, p. 67). CSCL is believed to be beneficial for educational practice due to both technological advancements in digital learning and better opportunities for students' active knowledge construction. In CSCL, learners are usually expected to work on complex phenomena with little interference from facilitators (Weinberger, 2011). Among the benefits of CSCL are better academic achievement, the development of higher order thinking skills, student satisfaction with the learning experience, and enhanced productivity (Resta & Laferrière, 2007).

However, collaborative learning is not a recipe. Collaboration does not produce any outcomes “by default”; instead, it depends on the extent to which learners engage in the collaborative process. There are three main categories of interaction that have been found to support learning: *explanation*, *argumentation/negotiation*, and *mutual regulation* (Dillenbourg et al., 2009). In their interactions, students manage social relations and perform cognitive and metacognitive aspects related to the task (Dillenbourg et al., 1996). In collaboration, students need to build a shared understanding of phenomena (Dillenbourg, Baker, Blaye, & O'Malley, 1996), and collaborative learning should lead to knowledge convergence (Weinberger, Stegmann, & Fischer, 2007). Therefore, the main purpose of CSCL environments is not only to make collaboration across distance possible

but also to build the type of environment where effective interactions among participants can occur (Dillenbourg et al., 2009).

Thus, while CSCL can be characterized by multiple opportunities that are not available for students in a traditional classroom setting, many learners experience significant challenges when they are simply assigned to groups and left to interact with their peers through technological tools. CSCL environments often turn out to be motivationally and cognitively much more demanding (Weinberger, 2011), and students without prior experience in the practice of collaboration often lack the knowledge of how to proceed (Fischer, Kollar, Stegmann, & Wecker, 2013). Therefore, it is not sufficient to simply provide students with the necessary tools and expect them to work on the problems outside of the classroom without any facilitation (Weinberger, 2011). Educators should not expect effective collaborative interactions to take place among students just because the technology makes it possible (Kreijns et al., 2003).

Moreover, educators must consider the psychological dimension of social interactions (Kreijns et al., 2003). It is necessary for the participants to introduce their own backgrounds to each other, discuss their goals, and define their roles and responsibilities at the beginning of the collaborative process for it to be successful (Munkvold & Zigurs, 2007). Processes such as getting to know one another, developing trust, and building the feeling of an online community are necessary for successful group formation and dynamics (Kreijns et al., 2003; Popov et al., 2017).

Over the past decades, various technological tools and platforms have emerged, allowing for different forms of distance interaction and participation. Moreover, CSCL researchers have significantly contributed to our understanding of the facilitation that is required by the participants in a CSCL setting. Thus, one of the key research streams within the field of CSCL has been collaboration scripting. The idea of collaboration scripts is to prompt desired interactions among students by, for example, describing a step-by-step procedure for performing a task and distributing roles for individual learners in a CSCL group (Weinberger, 2011). However, collaboration script researchers have a range of unanswered questions to address, including how to avoid cognitive overload for learners (Kollar, Fischer, & Slotta, 2007) and how to avoid a mismatch between the provided script and students' already established learning strategies (Kollar, Fischer, & Hesse, 2006; Kollar et al., 2007; Vogel, Wecker, Kollar, & Fischer, 2016). Empirical evidence

demonstrates that educators should not use a “one-size-fits-all” approach and that the design of collaboration scripts should be tailored to students’ prior knowledge (Mende, Proske, Körndle, & Narciss, 2017). Moreover, there has been only a limited focus on the role of the online facilitator in the context of CSCL (Kopp, Matteucci, & Tomasetto, 2012; Raes, Schellens, De Wever, & Benoit, 2016).

The focus of this research is on reaching a better understanding of the strategies for facilitating student engagement in the context of CSCL. The discussion centers around analyzing facilitation techniques for fostering effective student interactions and prompting their internalization. This research was mainly carried out in an asynchronous collaborative learning setting. Therefore, the implications of the asynchronous mode of interaction for collaborative learning are also explicitly addressed in the thesis. The research aims to formulate guidelines that can be applied by educators in CSCL settings, as well as contributing to the existing theories.

This study is conducted within the framing of an information systems (IS) PhD program. As will be discussed, the field of IS shares several focal areas with CSCL when it comes to facilitating collaboration practices, which is reflected in its long tradition of research on group support systems (GSS), virtual teams, and, more recently, collaboration engineering (CE). Thus, the dissertation is a cross-disciplinary work that combines the perspectives of CSCL and IS and aims to contribute to both domains by exploring the topical issue of effective online group facilitation.

1.1 Problem Statement

In this dissertation, the concept of engagement has an overarching role. In everyday use, this concept is often used interchangeably with motivation, emotions, and interest. While these concepts have strong links (Järvelä & Renninger, 2014), engagement has been given a narrower definition in the learning context: “Engagement stands for active involvement, commitment, and concentrated attention, in contrast to superficial participation, apathy, or lack of interest” (Newmann, Wehlage, & Lamborn, 1992, p. 11). Engagement in academic work requires psychological investment and effort toward mastering the knowledge (Newmann et al., 1992). The antecedents of engagement may be both social and academic, and they may arise from the opportunities available in the learning context for active participation, intellectual effort, and social relationships. Engagement is a multidimensional concept (Fredricks, Blumenfeld, & Paris, 2004) that can involve

behavioral engagement (i.e., actual participation and involvement in activities), *emotional engagement* (i.e., reactions to teachers, peers, and academic work), and *cognitive engagement* (i.e., investment and willingness to put effort into learning) (Fredricks et al., 2004). These various dimensions of the concept of engagement are applied in this research to illustrate the importance of various aspects of the CSCL environment (see Figure 1).

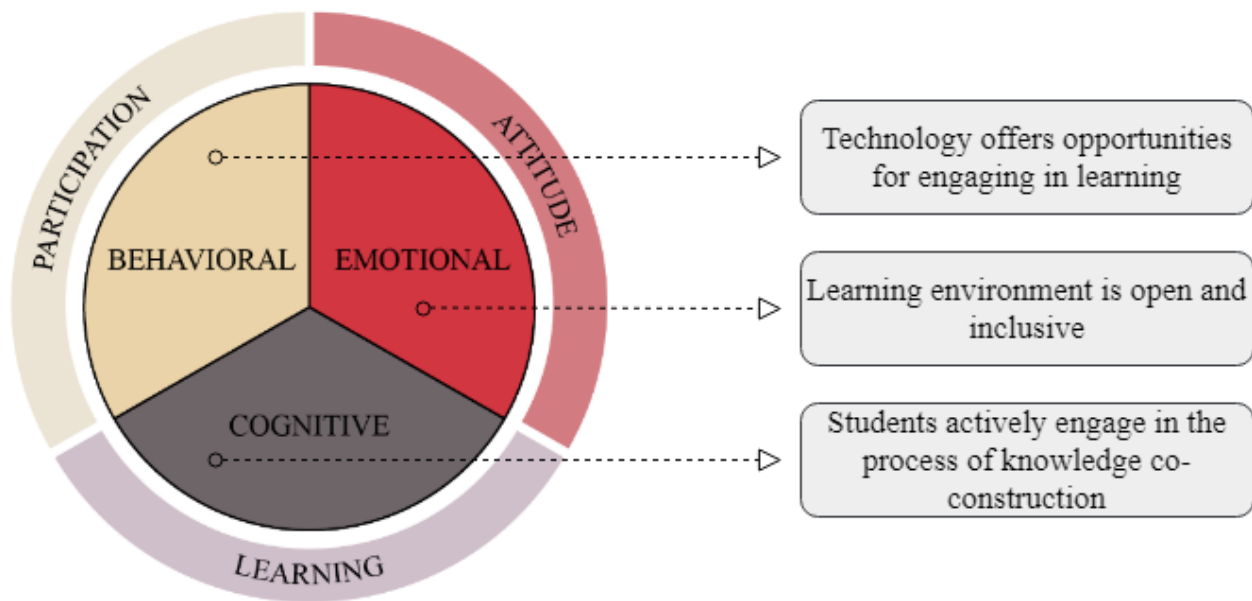


Figure 1. The concept of engagement applied in the research project.

In this project, the main research question (RQ) is formulated as follows: *How can students' behavioral, emotional, and cognitive engagement be supported in the context of computer-supported collaborative learning (CSCL)?*

One of the widespread problems in CSCL is over-expectations with regard to emerging media and their effects on learning. In fact, various tools have demonstrated conflicting results in CSCL (Dillenbourg et al., 2009). It is important that students are aware of the opportunities that the technologies offer for engaging in learning actively (Dabbagh, 2007). Thus, students need clear guidance on the use of the tools.

Another challenge in CSCL is the emotional component. While the dynamics of small group interaction can provide multiple opportunities for students engaged in learning, dysfunctional group dynamics can create difficulties (Määttä, Järvenoja, & Järvelä, 2012). The expression of emotions in virtual environments is often optional; therefore, it is an

additional challenge for participants to interpret each other's emotions (Järvelä, Hurme, & Järvenoja, 2011). Successful engagement in CSCL implies a setting where learners feel safe to take risks and share ideas. By contrast, some CSCL environments may decrease students' readiness to engage due to negative emotional and motivational experiences (Dillenbourg et al., 2009). It is an important part of the facilitator's job to ensure a comfortable social environment. In an online environment, the facilitator not only prepares and distributes materials by means of technologies but also motivates and guides each individual student (Stahl et al., 2006). It is especially important to address these issues in the initial phase of learning (Feng, Xie, & Liu, 2017). However, a better understanding of the role of the facilitator in the CSCL context is needed (Raes et al., 2016). In this research, I distinguish between two facilitator roles: the course instructor and the online tutor. While the course instructor is seen as responsible for the course design, including the choice and sequencing of the learning activities and materials, the online tutor is seen as responsible for interacting more closely with the online students and guiding them through the discussions and activities planned by the course instructor. This research focuses on the role of the online tutor, which is specified in more detail in Section 2.4.

Finally, the aspect of cognitive engagement needs to be addressed. One of the most vital questions for collaborative learning is how to stimulate high-level collaboration processes and learning outcomes (Fischer et al., 2013). The term "collaborative learning" describes a scenario where certain forms of interaction among learners are expected to take place, triggering learning mechanisms. However, there is no guarantee that these interactions will occur (Dillenbourg, 1999). Recent research efforts have focused on the implementation of collaboration scripts to trigger and facilitate effective collaborative processes among students, and particular attention has been paid to the transactivity of student interactions—that is, their ability to relate to and build on each other's contributions during the collaborative learning discourse (Weinberger, 2011). An additional challenge for CSCL is that learners often communicate in text-based environments, which makes it even more difficult to assess the quality of the metacognitive processes involved (Hurme, Merenluoto, & Järvelä, 2009).

To address the main question, the thesis focuses on three sub-questions:

- SQ1: How does the asynchronous mode of interaction affect the process of online collaborative learning in the context of a university course?
- SQ2: How can the online tutor contribute to building an inclusive online learning environment and promoting effective collaborative interactions among students in the context of a university course?
- SQ3: How can collaboration scripts promote effective online collaborative interactions among students in the context of a university course?

This research is part of the Agder Digital Learning Arena (ADILA) program, which focuses on the potential of digital media in higher education. The core idea of the ADILA program is to develop and implement research-based practices in order to provide better learning experiences for students and promote the potential of digital media in higher education at the University of Agder, Norway. The ADILA program is carried out as a multidisciplinary initiative, including seven individual PhD projects in the Faculties of Social Sciences, Education, and Engineering and Science.

Thus, the empirical context of this research are the courses run by the University of Agder. It is important to note that in the context of this project, CSCL is approached from the perspective of a *computer-mediated scenario*, where students are in different physical environments but the same technological environment.

1.2 Overview of the Theoretical Perspectives

This research has been inspired by insights from several theories in the fields of both education and IS. The use of multiple perspectives can contribute to a better understanding of complex phenomena occurring in the social world (Mueller & Urbach, 2013).

Affordance theory. Affordances are action possibilities—the preconditions for an activity—that are available in the environment (Gibson, 1986). Affordances need to be perceived by an actor to be further actualized. The actualization of affordances produces certain effects (Pozzi, Pigni, & Vitari, 2014). It is important to keep in mind that affordances can be not only enabling but also constraining (Hutchby, 2001; Van Osch & Mendelson, 2011). Exploring the affordances of certain technologies implemented in a specific field can help predict how the technologies will affect people’s actions and interactions (Van Osch & Mendelson, 2011). The theory of affordances has been topical

in the fields of both IS and education (Jeong & Hmelo-Silver, 2016; Lanamäki, Thapa, & Stendal, 2016; Pozzi et al., 2014; Suthers, 2006).

Theory of social presence. The theory of social presence is another theory that is relevant for both IS and education. The concept of social presence can be understood as “the degree to which a person is perceived as a ‘real person’ in mediated communication” (Gunawardena, 1995, p. 151). Therefore, much depends on the features of the communication medium. When the medium provides opportunities for transmitting information about facial expression, posture, and other nonverbal cues, it contributes to the degree of social presence (Gunawardena, 1995). When the technology does not provide sufficient opportunities for establishing the feeling of social presence among the participants, the role of online tutors becomes especially important as they can intentionally help students avoid feelings of loneliness and disconnectedness in the environment (Kopp et al., 2012).

Script theory of guidance (Fischer et al., 2013). This theory is recent and has not yet found its final shape (Stegmann, Kollar, Weinberger, & Fischer, 2016; Tchounikine, 2016). The theory is built around seven principles for how CSCL practices are affected by learners’ continuously modified internal scripts. It also addresses how internal scripts are developed during learners’ involvement in CSCL activities. According to this theory, it is necessary to apply the subject matter knowledge in a transactive way for the learning to be most effective. Finally, the theory addresses the issue of external scripts and their capabilities in the context of CSCL practices and internal script development (Fischer et al., 2013). External scripts are understood as embedded in the external environment to provide learners with hints for the expected collaborative behaviors, while internal scripts are viewed as being developed by learners themselves through learning by doing (Noroozi, Kirschner, Biemans, & Mulder, 2017).

Each of these theories brings an important perspective for understanding the phenomena under investigation, and combining their insights is helpful in addressing the stated research questions. The theory of affordances allows us to focus on the action possibilities provided by technologies, which implies that different actors can have different approaches to the use of technology. Understanding potential scenarios for the use of technology is important for providing adequate support to collaborating partners. Through the lens of the theory of social presence, it becomes possible to describe the online

collaborative learning environment in terms of inclusiveness and openness, as well as to single out specific aspects that need to be promoted. Finally, the script theory of guidance suggests a range of principles for directly prompting effective learning in a group of collaborating partners.

With regard to the causal structure of the theoretical approach (Markus & Robey, 1988), the discussion in this dissertation takes an *emergent perspective*, arguing that the use of information technology emerges from complex social interactions and that the way it emerges cannot be predicted. According to this perspective, a researcher cannot anticipate everything; knowledge of people's intentions and the features of the technology are not sufficient for predicting behavior. Thus, the affordances of a particular technology are only understood when someone starts using it. This perspective is in line with the essence of collaboration scripting, in which it is necessary to address ongoing changes in students' collaboration skills by adjusting the amount of facilitation. The theoretical lens of this project can be described as *process-oriented*. Process theories aim to explain how phenomena develop over time. In such theories, causation consists of not only necessary conditions but also random events; moreover, outcomes may fail to occur even if the necessary conditions are present. Finally, the analysis in this research is kept on the *micro level*, focusing on the properties of individuals and small groups.

1.3 Results

The results of this research have been presented in articles published in international conference proceedings and journals. All the papers bring theoretical, empirical, and/or methodological insights to the main question formulated in this dissertation. The papers are listed in Table 1.

For each paper, the extent to which it addresses the three research sub-questions is indicated. The papers contribute to different dimensions of the phenomena under study. The dissertation addresses the main question and presents directions for future research through insights gained from observations of collaborative learning in online courses (Paper 1), through presenting the student perspective on online tutoring (Paper 2), by discussing strategies for small group support (Paper 3), by drawing upon the current state of research on facilitating collaboration (Paper 5), and finally by providing the results of two experiments on collaboration scripting (Papers 4 and 6). The results of each paper are presented in Chapter 5.

Table 1. Thesis publications mapped to research sub-questions

Paper	SQ1	SQ2	SQ3
(1) Lazareva, A. (2015). Promoting collaborative interactions in a learning management system. <i>Proceedings of the 2015 International Conference on Interactive Collaborative Learning (ICL)</i> , pp. 421–430. IEEE.	v	v	
(2) Lazareva, A. (2017). Role of the online tutor in establishing social presence in asynchronous text-based collaborative learning environments. In M. E. Auer, D. Guralnick, & J. Uhomobhi (Eds.), <i>International Conference on Interactive Collaborative Learning</i> (pp. 128–142). Cham: Springer.	v	v	
(3) Lazareva, A. (2017). A framework for small group support in online collaborative learning: Combining collaboration scripts and online tutoring. <i>Proceedings of the 9th International Conference on Computer Supported Education (CSEDU)</i> , pp. 255–262. SciTePress.	(v)	v	v
(4) Lazareva, A. (2017). Facilitating synchronous collaborative writing with a collaboration script. In N. Paspallis, M. Raspopoulos, C. Barry, M. Lang, H. Linger, & C. Schneider (Eds.), <i>Information Systems Development: Advances in Methods, Tools and Management (ISD2017 Proceedings)</i> . Larnaca: University of Central Lancashire Cyprus.	v		v
(5) Lazareva, A., & Munkvold, B. E. (2017). Facilitating collaboration: Lessons learned and mutual synergies in collaboration engineering and computer-supported collaborative learning. <i>International Journal of e-Collaboration</i> , 13(3), 22–38.			v
(6) Lazareva, A. (under review). Fostering transactivity in asynchronous student discussions through role scripting. Submitted to <i>Computers & Education</i> .		(v)	v

1.4 Structure of the Thesis

The thesis consists of seven chapters. This introductory chapter has provided the background for the project and positioned it in the research areas of CSCL and IS, discussed the problem statement, and presented the research questions. Chapter 2 presents related research with a focus on the theoretical perspectives selected to guide this study. Chapter 3 provides a brief overview of methodological approaches in CSCL. In Chapter 4, the research strategy and methodologies employed in this research project are discussed. Chapter 5 is a condensed overview of the results, with a summary of each publication included in the thesis. Chapter 6 discusses the contributions of the research project from the practical, theoretical, and methodological perspectives. Finally, Chapter

7 concludes the thesis by presenting the answers to the research questions, discussing the limitations of the research, and suggesting implications for future work in the area. In addition, the following appendices are included: results of the literature review (Appendix 1), interview guides (Appendices 2–4), survey tool (Appendix 5), course evaluation survey (Appendix 6), coding schemes (Appendices 7–8), collaboration scripts (Appendices 9–10), and the six thesis publications (Appendix 11).

2 Related Research and Theoretical Perspectives

This chapter introduces the literature on the main concepts and phenomena under study and discusses the main theoretical perspectives in closer detail. The chapter starts with a discussion of the role of technologies and their affordances in the context of CSCL. It then moves on to the facilitation of collaborative learning by means of collaboration scripts. Collaboration scripting is a means to trigger students' actualization of the available affordances and facilitate effective types of collaborative interactions. Next, the concept of social presence and its importance for establishing an engaging and inclusive collaborative learning environment are discussed. It is argued that online tutoring is a vital social support that needs to be provided in an online collaborative learning environment in order to both establish a feeling of social presence and ensure the appropriation of scripts by students. The final section highlights the key aspects of the review and elaborates on how this work builds on earlier research.

2.1 The Role of Technologies and Their Affordances in the Context of CSCL

In CSCL, interactions and knowledge building in groups take place in online environments. The design of a computer system that mediates collaboration has a significant impact on the collaborative process (Dillenbourg et al., 1996). Since interactions among peers become the main component of learning, the tools should enable productive communication (Stahl et al., 2006). The main purpose of CSCL environments is, therefore, not only to make collaboration across distance possible but also to “create conditions in which effective group interactions are expected to occur” (Dillenbourg et al., 2009, p. 6). Thus, effective interactions may be hindered if the online learning environment is not motivating and provides limited opportunities for students' learning and interactions. In this research, the concept of affordances is employed to better understand the potential impact of technology on collaborative learning processes.

As they depend on the relationship between the actor and the object, affordances are not fixed features (Gibson, 1986). Affordances of the same object may vary depending on the situation or the actors and their expertise. These affordances are not always visible or known. Thus, affordances are not just functional aspects of an object; they are also relational. “Functional” means that affordances enable or constrain a certain activity with an object. “Relational” means that the affordances of the same object can be different for

different actors. Therefore, the full range of affordances may not be immediately perceived by a particular actor (Hutchby, 2001).

Norman (1999) addresses the difference between “real affordance” (i.e., the physical characteristics of an object allowing certain actions) and “perceived affordance” (i.e., the characteristics relating to the appearance of an object that give clues about how to use it). In the case of the latter, the perceived properties are not necessarily real. McGrenere and Ho (2000) discuss the differences between the definitions of Gibson and Norman: “The most fundamental difference between the two definitions is that for Gibson an affordance is the action possibility itself whereas according to Norman’s use it has been both the action possibility and the way that that action possibility is conveyed or made visible to the actor” (p. 3).

Thus, a certain technology possesses various affordances, but not all of these are easily perceivable (Jeong & Hmelo-Silver, 2016). While neither the writing (i.e., design) nor reading (i.e., interpretation) of technological artifacts is predetermined, there are certain preferred ways in which a technology can be interpreted (Hutchby, 2001). Norman’s approach is perhaps of interest for designers as it emphasizes the ease with which the user can perceive the affordance.

Several authors have contributed to advancing the concept of affordances by suggesting classifications for the types of affordances. Hartson (2003) approaches the discussion of affordances specifically from the point of view of interaction design, distinguishing four specific kinds of affordances to avoid ambiguities: 1) physical (helps in physically doing something, such as a reasonable location for a button in a software application); 2) cognitive (helps in thinking and/or knowing about something, such as clear words on a button label); 3) sensory (helps in sensing—an attribute of cognitive and physical affordances—such as an appropriate color for the font on the button); and 4) functional (the purpose of the physical affordance, such as sorting the documents after clicking the button). According to Hartson (2003), most errors occur when cognitive affordances do not signal, or falsely signal, physical affordances.

A more general classification has been offered by Van Osch and Mendelson (2011), who classify affordances into three large groups: 1) designed (purposely designed by the developers but not necessarily recognized and enacted by the users); 2) improvised

(perceived and recognized by the users even though they were neither recognized nor designed by developers); and 3) emergent (neither anticipated and designed by the developers nor actively improvised by the users in use but nonetheless affecting the interactions between the actors and the artifacts). As I use this classification to discuss the contributions of my dissertation, particular examples of designed, improvised, and emergent affordances can be found in Section 6.2.1.

The CSCL community has been showing more interest in the research on technological affordances (Zheng, Huang, & Yu, 2014). In their recent discussion of critical affordances for CSCL, Jeong and Hmelo-Silver (2016) discuss seven categories of affordances that technology should be able to offer learners:

- *Opportunity to engage in a joint task*: It is important to give learners something meaningful to interact with to engage them in collaborative processes. Technology can support this by integrating multimedia and digital artifacts in the learning environment.
- *Communication*: Effective communication channels are necessary.
- *Resource sharing*: Learners must be able to share resources.
- *Opportunity to engage in productive collaborative learning processes*: Online interfaces for scripted collaboration have been developed to help learners engage in effective collaboration. Such interfaces may include pre-organized input areas and message starters.
- *Opportunity to engage in co-construction*: Learners need to engage in co-construction in order to sustain joint attention and build upon each other's contributions. This may be supported by shared interfaces and dialogue tools that support transactive discussions (discussions where learners build on each other's contributions to develop and improve their knowledge further; Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2013; Vogel, Kollar et al., 2016).
- *Opportunity to monitor and regulate collaborative learning*: It is important that students engage in group regulation processes. Therefore, they need to be aware of their peers' activities. Awareness tools and learning analytics may help students coordinate their actions.
- *Opportunity to build groups*: Students must be able to build groups and communities (e.g., through social networks) to sustain their engagement over time.

According to Bower's (2008) perspective, the affordances of e-learning technology should be matched with the learning tasks to be as effective as possible. The theory of media synchronicity argues that "the fit of media capabilities to the communication needs of the task influences the appropriation and use of media, which in turn influence communication performance" (Dennis, Fuller, & Valacich, 2008, p. 576).

Since interactions among peers constitute the most significant part of the context of CSCL, distinguishing between synchronous and asynchronous types of interactions is especially important. For the purposes of information transmission (among individuals), media supporting lower synchronicity have been claimed to improve communication performance. By contrast, for the purposes of information processing (within individuals), media supporting higher synchronicity have been claimed to be optimal (Dennis et al., 2008). In asynchronous discussions the expected flow of interactions is violated due to delayed feedback, and there can be long pauses in communication. It is also normal for many topics to be active at the same time. Therefore, how teams organize and structure their interactions is important (Massey, Montoya-Weiss, & Hung, 2003). The asynchronous mode of interaction may often become a challenge. For example, learners may submit their comments and disappear, expecting their contribution to be easily incorporated in the final deliverable by the other group members (Curtis & Lawson, 2001). Asynchronous text-based interactions also result in a lack of visual cues, which is a challenge for both the instructors and students (Munkvold, Zigurs, & Khazanchi, 2011). Moreover, asynchronous notes in general contain more academic language (Oztok, Zingaro, Brett, & Hewitt, 2013) in comparison with synchronous communication where off-task social interactions naturally happen more frequently.

However, asynchronous communication has its own benefits for collaborative knowledge construction, including allowing time to reflect (Serçe et al., 2011). Moreover, one of the major shortcomings of oral, synchronous brainstorming is the need to manage the speech turns. Each of the participants must wait for his or her turn, and only one idea can be presented within each turn (Buisine, Besacier, Aoussat, & Vernier, 2012). In the asynchronous mode, all members can respond to the topic when it is most suitable for them to do so (Serçe et al., 2011). Some studies report on students preferring to use chat over voice discussions as this makes it easier to provide a short comment (Munkvold et al., 2011) and there is less non-task related talk taking place (Lazareva, 2017c). However,

earlier research suggests that communication performance is improved when a combination of media is used to perform a task rather than just one specific medium (Dennis et al., 2008).

2.2 Scripting Collaboration

Collaborative learning is the result of a continued attempt to reach and maintain a shared understanding of a concept (Roschelle & Teasley, 1995), which depends on students' own efforts and the intensity of the interactions (Dillenbourg et al., 2009). Communication processes such as turn taking, feedback, and shared understanding are necessary for effective collaboration (Rummel & Spada, 2005). Theoretically, collaboration may happen spontaneously, but in practice this does not usually happen (Strijbos, Martens, & Jochems, 2004). The effectiveness of collaborative learning depends on multiple factors whose interactions are not always possible to predict. Therefore, instead of seeking to identify and predict the critical factors, researchers and scholars have attempted to directly influence the flow of collaborative learning (Dillenbourg, 2002) through, for example, the use of collaboration scripts.

One of the goals established during this research project was to provide a comprehensive review of collaboration scripting research. Therefore, extensive details and discussion of the issues of collaboration scripting can be found in Lazareva and Munkvold (2017; see Appendix 11). In this section, I highlight only the key points.

Collaboration scripts have been a topical research focus in CSCL, with scholars investigating the strategies for triggering productive interactions among peers (Dillenbourg et al., 2009). According to Rummel and Spada (2005), "the main idea behind the usual application of cooperation scripts is to enforce a fruitfully structured interaction by giving precise instructions on how to interact and thus improve the joint problem-solving and knowledge acquisition" (p. 210). As Weinberger (2011) argues, "few unscripted learners effectively apply self-regulation strategies for transactive collaborative learning, such as sufficiently analyzing online learning partners' contributions and their relation to one's own standpoints" (p. 198). In the case of challenges, students may prefer to wait for the instructor to help solve the situation than be proactive themselves (Munkvold et al., 2011). Scripts can bring educational design into online learning without direct facilitator intervention (Weinberger, 2011).

Scripting can be achieved through software design (e.g., making it impossible to post an entry until all the group members have contributed) and by assigning certain roles (e.g., analytical and critical) to different learners during the process (Weinberger, 2011). One critical issue regarding scripts is that the script representation needs to be authoritative if the learners are to follow it. Many CSCL scripts are embedded in the environment only through text prompts, and these are often disregarded by students and considered redundant (Weinberger, 2011).

Kollar et al. (2006) define scripts as “scaffolds that aim to improve collaboration through structuring the interactive processes between two or more learning partners” (p. 159). Collaboration scripts aim to provide learners with certain socio-cognitive structures that support the desired interaction pattern. Thus, instruction by scripts implies specific expected behaviors from students. Scripts make concrete suggestions and prompts regarding how to act, and they can also take care of role rotation to ensure equal participation. Scripts can also support students to reduce process losses by organizing the grouping of learners, distributing tasks among the group members, and setting the time frames. Scripts can also foster awareness so that students have a clear idea of how the roles will be rotated and how the activities will be distributed throughout the course (Weinberger, 2011).

Thus, the basic principles of scripts can be identified as the following: regulating learning activities, providing complementary procedural knowledge, providing process-oriented instruction, alleviating coordination, and fostering awareness (Weinberger, 2011, p. 192).

It has been empirically proven that collaboration scripts have an immense potential to support CSCL learners (Noroozi et al., 2013; Popov, Biemans, Kuznetsov, & Mulder, 2014; Weinberger, Stegmann, & Fischer, 2010; Wichmann & Rummel, 2013). It has been demonstrated that “learning by unguided collaborative problem-solving on a task is much less effective than systematic intervention and almost as bad as having no opportunity for learning at all” (Rummel & Spada, 2005, p. 234). A recent meta-analysis on collaboration scripts (Vogel, Wecker, et al., 2016) demonstrates that learning with scripts has a strong positive effect on collaboration when compared to unscripted CSCL. Students acquire effective collaborative learning skills when they are repeatedly supported by scripts (Vogel, Wecker, et al., 2016).

At the same time, there have been a range of empirical studies providing mixed results (Bouyias & Demetriadis, 2012; Raes et al., 2016; Stegmann, Weinberger, & Fischer, 2007; Wecker, Kollar, & Fischer, 2010; Weinberger, Ertl, Fischer, & Mandl, 2005). The challenges have been identified in collaboration scripting research include *over-scripting*, that is, providing a structure that is too rigid (Dillenbourg, 2002), which may lead to overload in learners (Kollar et al., 2007) and make them avoid using the script completely (Popov, Biemans, et al., 2014); *limiting reflective thinking* (Weinberger et al., 2005); and internal scripts, that is, dependence on students' already established strategies for collaborative learning situations (Kollar et al., 2006; Kollar et al., 2007; Vogel, Wecker, et al., 2016). External scripts may guide CSCL practices either by facilitating or inhibiting the application of internal script components in the collaborative learning situation. In the former case, an external script provides affordances that affect the learners' choice of the necessary internal script components. In the latter case, an external script reduces the probability of dysfunctional internal script components (e.g., allowing the task activities to proceed without the students having clear roles in the group) being chosen and applied (Fischer et al., 2013).

Although some scholars (Rummel, Spada, & Hauser, 2009) have argued in favor of *adaptive scripting* (i.e., fading scripting out gradually or introducing it only when needed), there is a concern that this provides students with less scaffolding overall (Gweon, Rosé, Carey, & Zaiss, 2006). Moreover, there have been empirical studies demonstrating that fading out scripting was not effective (Bouyias & Demetriadis, 2012; Wecker et al., 2010).

Many research findings show that it is difficult to effectively promote the simultaneous acquisition of both domain-specific knowledge and general collaboration skills through scripts (Kollar et al., 2007; Rummel et al., 2009; Stegmann et al., 2007; Weinberger et al., 2005). Instead, it has been suggested that scripts should be designed to facilitate certain types of tasks (Vogel, Wecker et al., 2016), and that they should consider the level of learners' domain-specific prior knowledge (Mende et al., 2017).

In any kind of collaborative learning situation, the quality of collaborative dialogue is extremely important. In productive dialogue, peers build upon each other's contributions, clarifying, challenging, asking and answering (Clark & Mayer, 2011). Transactivity, that is, students' ability to relate to each other's statements, building upon and modifying

them, as well as integrating them into their own line of reasoning (Weinberger, 2011), can be increased by scripts (Stegmann et al., 2007; Weinberger, 2011). Recent research argues that scripts that do not aim to foster transactivity may not be an optimal choice in the CSCL setting (Vogel, Wecker et al., 2016). The findings of a recent study by Popov et al. (2017) demonstrate that the occurrence of high-level transactivity interactions did not predict the quality of group products. The authors discuss the variables that could potentially influence the collaboration process, emphasizing the importance of group dynamics, collaborative strategy, and communication skills. They suggest that students need to be trained to engage in transactive interactions and that support for both the social and cognitive aspects of collaboration should be provided (Popov et al., 2017).

2.3 Social Presence

It is important to ensure sociable CSCL environments that can provide students with non-task contexts and allow them to socialize off-task (Kreijns et al., 2003). Social interactions and utterances are important in enabling learning interactions (Curtis & Lawson, 2001), and non-task sociability increases when students are aware of each other and are cohesive (Abedin, Daneshgar, & D'Ambra, 2011).

It is not uncommon for students in online learning environments to experience a lack of social connection with the other participants. This happens because online learning tends to rely on text-based communication and takes place across time and space (Sung & Mayer, 2012). A key difference between interacting by means of text and interacting face-to-face is that, in addition to what is verbalized, the latter includes a variety of nonverbal cues such as facial expression and posture (Gunawardena, 1995). It is thus easier to create common ground, which is an important precondition for effective collaboration. Unlike online environments, face-to-face contexts allow such common ground to be reached through nodding, gestures, eye contact, and other non-verbal behaviors (Eryilmaz, Ryan, Van der Pol, Kasemvilas, & Mary, 2013). Moreover, in asynchronous text-based communication, the feeling of social presence is often based on participants' expectations of when their peers will check the communication channels (Sarker & Sahay, 2004).

Sung and Mayer (2012) define social presence in an online learning environment as “the degree to which a learner feels personally connected with other students and the instructor in an online learning community” (p. 1738). Remesal and Colomina (2013) offer a more elaborate definition of social presence, stating that it is “the result of constructive and

evolutionary discursive group interaction which promotes the creation of a community feeling, the maintenance of positive relational dynamics, and the enhancement of self- and collective efficacy in front of the learning task, in such a way that the learning process is supported” (p. 358).

Most of my research was carried out in an asynchronous text-based collaborative learning context. In such environments, there is often a need for additional facilitation that can trigger the feeling of social presence in online collaborative learners. Therefore, technology should be considered together with other forms of social support (Jeong & Hmelo-Silver, 2016), including the involvement of an online tutor. Empirical findings demonstrate that it is especially important for online tutors to focus on establishing social presence in the initial phase of learning. If this is done successfully, social scaffolds can be withdrawn in the later stages. Effective strategies for social presence include a welcome letter, the use of friendly language, emotional words and graphic symbols, online ice-breaking activities, thanking students for their contributions, and using the names of students when posting (Feng et al., 2017).

2.4 Role of the Online Tutor

In addition to establishing and maintaining the feeling of social presence in the online learning environment, the online tutor is a crucial resource from the pedagogical, managerial, and technical perspectives (Berge, 1995). The online tutor is responsible for following student discussions and providing guiding hints during the learning process. The online tutor also ensures that students use the technology effectively and appropriate the collaboration scripts. However, some recent research recommends that in addition to the online tutor, there should also be someone who is able to address technical issues during online sessions (de Jong, Verstegen, & Könings, 2017).

In general, the role of the online tutor has been scarcely addressed in the existing research, although this topic has recently gained more interest, resulting in more empirical work (Feng et al., 2017; de Jong et al., 2017; Kopp et al., 2012). One of the critical questions is “whether experienced e-tutors just intuitively support online collaboration based on their naïve beliefs and on the functioning of virtual collaboration in their daily practice, or whether they have the theoretical and empirical knowledge as a basis on which to act in a reflective and profound manner” (Kopp et al., 2012, p. 19). The necessity of appropriate training for novice online tutors thus becomes clear. Banks,

Denis, Fors, and Pirotte (2004) describe different practices for e-tutor training. As the tutor's role depends on the context, it is challenging to identify a common profile for all e-tutors. E-tutor training can be delivered in diverse ways. Banks et al. (2004) suggest that there should be opportunities for tutors to collaborate and to observe role models (i.e., experienced tutors). In addition, Goold, Coldwell, and Craig (2010) suggest that it would be beneficial for novice tutors to have a platform for discussing challenges as well as sharing successful experiences. Expert tutors could also be more proactive in consulting novices and serve as role models.

Experienced online tutors have been found capable of scaffolding students in their understanding of the content. According to Goold et al. (2010), instead of focusing on the quality and depth of understanding, novice tutors focused on “ensuring students completed the requirements of the assessment, reminding them about deadlines and the need for timely participation, as well as assisting them by organizing the discussion threads” (p. 711). The online tutor's reminders about the importance of participation in the forum may not always be effective; however, tutors who post guiding questions are likely to be more successful in involving students (Lazareva, 2015b). Experienced tutors tend to support content-specific cognitive activities in students more frequently, probably because they are more able to detect dysfunctional processes in the group (Kopp et al., 2012). Moreover, experienced tutors tend to intervene more frequently to scaffold specific activities and prevent dysfunctional phenomena in the group, and they also put more weight on long-term planning and organization than novice tutors (Kopp et al., 2012). However, it is difficult to say whether more frequent interventions are the best solution, as students may become dependent on the tutor's contributions and focus on addressing the tutor's requests rather than interacting with each other (An, Shin, & Lim, 2009).

2.5 Information Systems Research on Collaborative Learning

Given the cross-disciplinary focus of this research project, a relevant question is the extent to which issues of collaborative learning and online collaborative learning are addressed in the field of IS. To identify the IS research of direct relevance for CSCL, a review of the eight “basket” IS journals (defined by senior scholars in the Association for Information Systems as the top journals in the field) was conducted. The review covered the period from 2000 to 2015, using the following selection procedures:

- The journals’ archives were explored using the search terms “computer-supported collaborative learning” or “collaborative learning” or “online learning.”
- Article titles and abstracts were evaluated manually. Where necessary, the articles were skimmed for better understanding of the context and implications. Only papers focusing on the learning perspective were selected, resulting in a final sample of 14 papers.
- The papers from the final set were read and summarized.

Throughout the period reviewed, only scattered contributions in the following five of the eight “basket” IS journals were found: *European Journal of Information Systems (EJIS)*, *Information Systems Research (ISR)*, *Journal of the Association for Information Systems (JAIS)*, *Journal of Information Technology (JIT)*, and *Journal of Management Information Systems (JMIS)*. No papers of direct relevance for CSCL were found in *Management Information Systems Quarterly (MISQ)*, *Information Systems Journal (ISJ)*, or *Journal of Strategic Information Systems (JSIS)*. Of the sample of 14 papers identified (see Appendix 1), four articles are conceptual, discussing the potential of IS research for technology-mediated learning (TML). Three articles are labeled as “explorative.” These focus on aspects that have not been clearly defined in the extant research, using a more open research design compared to the experimental studies. The papers focus on active learning and collaboration and demonstrate growing interest in understanding and facilitating learning communities. Finally, the third category of articles employed an experimental design, comparing the relative effectiveness of different systems or conditions. This category of papers comprises half of the total sample of articles identified. Several of the papers focus on experimental research, comparing groups facilitated by GSS with groups working without technology support. GSS in this research are defined as “interactive computer-based environments which support concerted and coordinated team effort toward completion of joint tasks” (Nunamaker, Briggs, Mittleman, Vogel, & Balthazard, 1996, p. 165).

Thus, although there is interest in the issues of online collaborative learning in the field of IS, it seems that research on collaborative learning is not highly represented in the top IS journals. However, CSCL has many points in common with the field of IS. CSCL shares a focus on group collaboration through technology with the IS research on GSS (Nunamaker et al., 1996) and, more recently, virtual teams (Pinsonneault & Caya, 2007).

Another research direction that resonates with CSCL research is the field of CE, which is focused on the design of collaboration processes for frequently recurring collaborative tasks (Hengst & de Vreede, 2004; de Vreede, Briggs, & Massey, 2009).

Virtual team researchers have identified various challenges during the process of virtual team collaboration that share similarities with those reported by CSCL researchers. These include slow start-up phases, ignoring the aspects of team development and planning, not communicating individual time constraints to those who are ready to work (Munkvold & Zigurs, 2007), a lack of shared understanding among team members (Munkvold et al., 2011), inefficient exchange of information and planning (Powell, Piccoli, & Ives, 2004), and extra challenges related to coordination activities (Powell et al., 2004; Pinsonneault & Caya, 2007). Moreover, a lack of preexisting common ground among the participants often makes it more difficult to reach the state of collaboration (Sarker & Sahay, 2003), and virtual teams must engage in more communication episodes to develop the same degree of cohesiveness compared to traditional teams (Pinsonneault & Caya, 2007).

Similarly, CE research has a range of common interests with the field of CSCL. We have reviewed a representative sample of the literature from each research stream and concluded that both CE and CSCL aim not only to facilitate collaboration practices but also to help groups develop sustainable practices that they can later apply by themselves (Fischer et al., 2013; Randrup & Briggs, 2015). Moreover, both CE and collaboration script researchers are concerned with effective practices that can be carried out across various technological platforms (de Vreede et al., 2009). While both fields are concerned with designing prompts for effective group interactions, they also acknowledge that it is necessary to ensure that the provided guidelines can be adapted for a specific collaboration situation (Briggs, Kolfschoten, de Vreede, Lukosch, & Albrecht, 2013; Kobbe et al., 2007; Rummel et al., 2009). We present our detailed discussion of the potential synergies between the two fields in one of the thesis publications (Lazareva & Munkvold, 2017).

2.6 Summary of the Theoretical Background

This chapter has introduced the main concepts and theoretical perspectives that this research builds on. Combining the three theoretical frameworks elaborated makes it possible to address the concept of student engagement in online collaborative learning in

a comprehensive manner. In the following, I elaborate on how the chosen theoretical perspectives contribute to my research (see Table 2 for a summary of the discussion).

Table 2. Summary of the chosen theoretical perspectives

Theoretical perspective	Important for understanding	Why this perspective was chosen
(1) Affordances	SQ1 —students’ behavioral, emotional, and cognitive engagement —students’ use of alternative communication media —the development of students’ collaborative learning strategies	—focuses on affordances instead of a specific technological tool, which makes the discussion relevant for various contexts —works well for understanding how the same technology can have varying impacts on the learning process for different learners
(2) Script theory of guidance	SQ2, SQ3 —students’ behavioral and cognitive engagement —the mechanisms contributing to the transactivity of student interactions —the role of the tutor in online collaborative learning	—collaboration scripting allows for the targeted facilitation of specific components of the learning situation —collaboration scripts can be introduced either through the interface of the technology or as an extended instruction —acknowledges differences in the level of collaboration skills among learners
(3) Social presence	SQ1, SQ2 —students’ behavioral, emotional, and cognitive engagement —the role of the tutor in online collaborative learning —students’ use of alternative communication media	—acknowledges the importance of both the technology and human actors —explicitly addresses the psychosocial issues in the learning context, which are often underemphasized
SQ1: How does the asynchronous mode of interaction affect the process of online collaborative learning in the context of a university course? SQ2: How can the online tutor contribute to building an inclusive online learning environment and promoting effective collaborative interactions among students in the context of a university course? SQ3: How can collaboration scripts promote effective online collaborative interactions among students in the context of a university course?		

The common starting point for all three perspectives is that they consider the actor (i.e., the student) as always being able to act otherwise. Applying these perspectives in combination allows us to reach a better understanding of the possible scenarios affecting student engagement in online collaborative learning.

(1) The relational concept of *affordances* suggests that students may not necessarily employ the technological tools in the expected way. The technology may affect the interactions among students in unforeseen ways. Thus, it is important to acknowledge the existing affordances and be aware of their possible impact on the collaborative learning process. The empirical investigation in this thesis was mainly conducted in the context of a learning management system (LMS). Although the opportunities provided for students by an LMS may be limited (Dabbagh & Kitsantas, 2012), with student interactions being restricted to asynchronous text messages, there is a persuasive argument in favor of discussing the LMS as a context of collaborative learning. Although various technological advances are currently available, many educational contexts do not have access to the most recent technologies. Many universities offer courses on an LMS or similar platform. Therefore, it is important to understand the affordances and constraints of this type of technology for collaborative learning interactions. Specifically, this project focuses on the synchronicity of student interactions. Its focus on the affordances of the technology rather than on specific technological tools makes the discussion relevant and applicable to variant technological settings. The affordances lens contributes to understanding SQ1.

(2) *The script theory of guidance* acknowledges that different learners are likely to differ in terms of the level of their collaboration skills. Thus, collaboration scripting in this project is a means to prompt students' actualization of the available affordances in ways that can result in effective collaborative learning interactions. Existing research on collaboration scripting makes it possible to single out and target specific components of the learning situation (e.g., role distribution and the sequencing of activities). Thus, applying a collaboration scripts perspective allows for better understanding of the mechanisms affecting the transactivity of student interactions. Moreover, a collaboration scripting approach can reveal the phases of the collaborative learning process during which the online tutor's intervention may be necessary. The collaboration scripting approach is important for understanding SQ2 and SQ3.

(3) Finally, the *social presence* lens is crucial in this project as it addresses psycho-social issues in the context of online collaborative learning. The concept of social presence assigns importance to both the features of the technological medium and the actors participating in the online learning process. In this project, it is argued that online tutoring is an important social support. In asynchronous text-based learning environments in particular, this support needs to be provided in order to build a feeling of social presence. The concept of social presence helps address SQ1 and SQ2.

3 Overview of Methodological Approaches in CSCL Research

The purpose of this chapter is to provide a brief overview of methodological issues in CSCL research, outlining challenging aspects that informed the methods of data collection and analysis employed in this research project.

For many years, theories of collaborative learning tended to focus on how individuals function in a group. The initial goal of the empirical studies in this area was to find out under what conditions learning in groups was more effective than learning alone, and researchers attempted to control for different variables such as size or composition of the group. However, it was difficult to make solid predictions because it was next to impossible to establish clear links between the conditions and the effects of collaboration. Thus, the results obtained from the research were not clear (Dillenbourg et al., 1996).

Pedagogical studies generally underline that individual learning necessarily occurs within a social context and is built on foundations of shared knowledge (Stahl, 2006). As Brown and Duguid (1991) state, “individual learning is inseparable from collective learning” (p. 46). Even when an individual person builds understanding in isolation, it should not be forgotten that this is still a social act as it is based on culturally defined artifacts and oriented toward other people in society. An important duality should be kept in mind: individual practices are social, but at the same time social norms are rooted in individual actions. Therefore, both individual members and a collaborative group are important for knowledge building (Stahl, 2006).

Moreover, studying collaborative learning situations is in general different from studying individual learning. In collaborative learning, participants always display their learning and understanding as a part of collaboration, and researchers should make use of these displays. In addition, observations often happen during short periods of interaction as opposed to across lengthy periods between pre- and post-tests (Stahl et al., 2006).

Thus, to understand what causes the effects, it is necessary to understand how interactions work in collaboration, which implies the need for new methodologies for analyzing and interpreting group interaction processes. The focus, therefore, is no longer on what is in the students’ heads but rather what is happening among them during interactions. Thus, when studying collaboration, it becomes essential to capture the process of shared

meaning construction, which is not possible to achieve with the use of pre- and post-tests (Stahl et al., 2006).

Although quantitative studies of learning outcomes under established conditions can provide valuable empirical data, it should be acknowledged that they are not sufficient for telling the whole story (Stahl, 2006). To understand the processes taking place during collaborative learning, it is necessary to approach the phenomena as they gradually unfold during the period of study. To study CSCL practices, there is a need to consider a multidimensional shared world full of interactions, which is situated in a specific context that learners create together (Stahl & Hesse, 2010). CSCL research in general thus moved from quantitative analysis to studies also using methodologies such as conversation analysis, video analysis, and ethnomethodology, which result in detailed case studies of collaborative learning (Stahl et al., 2006).

Stahl (2006) argues that empirical assessment of collaborative achievements should consider individual, group, and community levels and demonstrate how these levels interact. Different concrete methodologies can be employed to achieve this. These include assessing individual outcomes under controlled conditions, analyzing thread statistics that can provide a quantitative measure of discourse, and coding discourse utterances according to their content or style. However, although such methods shed light on some aspects of group processes, they do not allow the researcher to follow the development of ideas in the group. Conversational analysis can be helpful in providing a detailed understanding of group learning; however, it is labor-intensive, requiring close analysis based on the interpretation of sequences of utterances.

Stahl et al. (2006) point to three methodological traditions in CSCL: experimental, descriptive, and iterative design. Much of the empirical CSCL research follows the experimental tradition where an intervention is compared to a control condition with respect to certain variables. In this tradition, learning outcomes are measured and interactions categorized, and groups are then compared through statistical methods to find out the effects of certain variables. As a result, the accomplishment of intersubjective learning is not directly analyzed. Descriptive studies involve an ethnomethodological approach. This grounded approach is data-driven, and researchers seek to discover patterns rather than imposing existing theories and categories on the data. Such

descriptive methodologies are not particularly suited for forming generalizations. Moreover, while there are many examples of successful collaborative situations, it is not easy to find descriptions of those that failed. A weak point of data-driven studies is that in order to find something, the researcher needs to know what he or she is looking for. Finally, the iterative design tradition involves design-oriented researchers who continuously work on and improve the artifacts mediating collaboration. This research can also be called explorative.

In recent years, new methods have been coming into use, such as learning analytics (Xing, Wadholm, & Goggins, 2014). Computational methods can be viewed as a promising means to rapidly improve our understanding of collaborative learning. At the same time, they can be criticized as focusing mainly on structure and the discovery of regularities in the data rather than on the process of collaborative learning and meaning making (Wise & Schwarz, 2017). However, more attention is now being paid to connecting participants' actions, gestures, and conversations in the process of meaning making. In particular, the interaction analysis approach (Jordan & Henderson, 1995) has been extended to include the analysis of participants' physical movements (Ludvigsen, Cress, Law, Stahl, & Rosé, 2017). Although this approach can provide rich insights, it can be criticized for being time consuming and thus limiting overall progress in the field.

Therefore, despite growing interest in CSCL, there is a range of methodological challenges where the research community has not yet reached consensus (Ludvigsen et al., 2016; Stahl, 2006; Wise & Schwarz, 2017). Some of the problematic issues include the overall validity of research results in the field (including the need for more replication studies), the need for more longitudinal studies, and the need to study collaborative knowledge construction beyond formal educational settings (Ludvigsen et al., 2016). The methodological diversity is not only caused by employing different methods but also comes from different perspectives on what it means to understand something (Wise & Schwarz, 2017).

An issue of particular interest in the context of this dissertation is that the sciences in which most CSCL researchers have been trained (e.g., psychology, education, and linguistics) usually focus on individuals as the subject (Stahl & Hesse, 2010). The review by Gress, Fior, Hadwin, and Winne (2010) serves as a good illustration as it demonstrates that the focus of assessment in CSCL has mainly been on the measures taken *after* the

collaborative learning process. This means that most of the data collected describe the state where possible changes in individuals' learning and skills have already occurred. These data focus on the products of collaboration as opposed to the processes. From the methodological perspective, the focus should be on refined methods that are able to capture intersubjective meaning making, shared understanding, and knowledge building, as opposed to methods focusing on individual learning in the context of social interactions.

The methods of data collection and analysis employed in this work are presented in detail in Chapter 4. Rather than focusing on individual learning in the group context, this research project aims to understand how groups develop their shared norms and routines and learn together. Even when an experimental research design was employed to study the effects of collaboration scripts, the focus remained on assessing the quality of interactions among students (and online tutors) in online collaborative learning discussions, in contrast to measuring individual students' learning outcomes (e.g., through pre- and post-tests).

4 Research Approach

The role of this chapter is to present the overall vision of the research approach, outlining a detailed research design of the empirical studies employed and connecting the individual components of the study holistically. The chapter starts by discussing the research perspective and then moves on to the methods of data collection and analysis. At the end of the chapter, the quality criteria that are used to assess this research project are discussed and the ethical considerations are considered.

4.1 Research Perspective

This project is based on the interpretivist paradigm. Unlike positivist approaches, which are mainly aimed at testing theories and increasing our predictive understanding of phenomena through quantifiable measurements of variables, interpretive studies support the vision that people build their own subjective and intersubjective meanings in the process of interaction with the world. Interpretive studies seek a relativistic and shared understanding of phenomena. Interpretivism assumes that it is not possible to understand reality without considering the social actors, including the researchers, who make sense of that reality. Ontologically, this approach underlines the importance of subjective meanings, whereby the social world is produced by humans in the process of action and interaction. As Guba and Lincoln (1994) state, “human behavior, unlike that of physical objects, cannot be understood without reference to the meanings and purposes attached by human actors to their activities” (p. 106). While positivists want to discover reality, interpretivists claim that it is only possible to interpret it. Epistemologically, the interpretive position implies that understanding social processes requires being part of the world where these processes are generated. Interpretivism underlines that the researcher’s prior assumptions, beliefs, and values have a significant impact on the investigation (Orlikowski & Baroudi, 1991). Thus, any interpretation reflects the perspectives of the individual researcher (Van de Ven, 2007), and researcher bias should be reflected on in any research study (Munkvold & Bygstad, 2016).

Walsham (1995) outlines four forms of generalization arising from interpretivist research: the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insights. The contributions of interpretivist studies may be viewed as tendencies that may or may not occur in other situations (Walsham, 1995). In this research project, the latter two forms of generalization are

targeted. This research first aims to draw specific implications relating to the context of online collaborative learning, such as the relationship between facilitation strategies and the transactivity of student interactions. Such generalizations are approached as tendencies rather than predictions. Second, this research is also designed to provide insights obtained from the context of collaborative learning. The investigation is carried out from a small group perspective, which allows for detailed descriptions of the learning processes taking place among the participants of collaborative learning groups. Such descriptions may uncover some of the aspects of collaborative interactions that often remain unnoticed, which is important for a deeper understanding of student learning. Thus, thesis publications 1, 4, and 6 provide a detailed account of the learning processes taking place in each of the groups participating in the study.

4.1.1 Role of the Researcher

As Walsham (1995) states, “interpretive researchers are attempting the difficult task of accessing other people’s interpretations, filtering them through their own conceptual apparatus, and feeding a version of events back to others, including in some cases both their interviewees and other audiences” (p. 77). According to Walsham (1995), two roles of the researcher can be identified: the outside observer and the involved researcher. He later clarifies that although this distinction is useful, it makes sense to view the type of researcher involvement as a spectrum, acknowledging that it may often change over time (Walsham, 2006).

During this project, my role as a researcher was changing. I began by conducting an interview with the course coordinator for an online Master’s degree program and later moved on to carrying out observations in the context of two courses in this program. Thus, I started out as an *outside observer*. A benefit of this approach is that the research participants are often frank in their actions and expressions as they do not see the researcher as having a direct personal bias with respect to the potential outcomes. On the other hand, as an outside observer, the researcher is often left out of many occasions that would contribute to an understanding of the context from the inside (Walsham, 1995). The program coordinator openly pointed out the advantages and weaknesses of the online program setup. The students whose online collaboration was observed knew about the presence of the observer. They provided their consent to be observed, and the presence of the observer did not seem to constrain their usual flow of interactions. However, having

entered the research context as an outsider, I may have missed out on some of the aspects related to the background of the online program as well as the background and previous experiences of the participants.

In the remaining (and largest) part of this project, I conducted interviews with the students and analyzed their learning processes online. As I was either an online tutor or guest lecturer in these contexts, my role was that of an *involved researcher* for the largest part of this research project. This has several advantages. Close involvement results in better and more in-depth access to people and data. The researcher can participate in or observe the action. Finally, the participants may perceive the researcher in a more positive light because they realize that the research is being done for their own good rather than merely for the sake of the academic literature. However, close involvement also has several disadvantages or risks. First, participants may act more closed if they perceive that the researcher has a vested interest. Moreover, the researcher may start identifying himself or herself with the people in the field and thus lose a fresh outlook and critical attitude on the situation (Walsham, 2006). The participants were interested in providing their feedback and views on the issues of online tutoring and the course setup as their feedback was considered for further course improvement. Moreover, being emerged in the context of the investigation led to the advantage of being familiar with the context, background, and personal characteristics of the participants, which were important to consider during the analysis of the data collected from the student learning activities.

4.1.2 Role of Theory

Walsham (1995) discusses three examples of the use of theory in interpretive studies: as an initial guide to the design and data collection, as part of an iterative process of data collection and analysis, and as a final product of the research.

In this project, theory was used as part of the iterative process of data collection and analysis. As Walsham (1995) notes, even though a theory can provide valuable insights for the researcher in terms of guiding the design of the study and data collection, there is a danger that the researcher may start using the theory in an overly rigid way, thus narrowing his or her outlook and openness to novel issues. In agreement with this observation, I have attempted to be open to the data collected during the research and willing to challenge the initial theoretical assumptions through novel insights emerging from the empirical data.

4.1.3 Research Design

This project follows a sequential multimethod research design whereby different methods are employed, with the results feeding into each other (Mingers, 2001). Thus, varying methods of data collection and analysis were employed: interviews, observations, surveys, and experimental setups. The methods of data collection and analysis are elaborated in detail in Sections 4.2 and 4.3.

Since its early stages, this project has aimed to bridge the gap between research and practice, being a form of engaged scholarship. Engaged scholarship addresses the theory–practice gap by producing scientific knowledge and communicating it to practicing professionals (Mathiasen & Nielsen, 2008). My involvement in the teaching activities of the University of Agder allowed me not only to explore but also to have a direct impact on the teaching practices. I have carried out training sessions for Master’s degree students in an online study program. Moreover, I have presented and discussed my research with the faculty who are engaged in the revision and improvement of current teaching practices. I have also recorded a range of video lectures that can be used by the faculty.

The aspects of the research perspective are summarized in Table 3.

Table 3. Summary of the project’s research perspective

Elements of the research perspective	Approach appropriated in this research
Ontology	Relativist
Epistemology	Interpretivist
Role of the researcher	Outside observer → involved researcher
Role of theory	Part of an iterative process of data collection and analysis
Research design	Sequential multimethod research design

4.2 Context and Methods of Data Collection

The selected research methods are instruments for provoking a response from the world and generating information about its aspects. To get richer results, it is desirable to use various research methods in combination (Mingers, 2001). This research project used various methods of data collection and different data analysis techniques, depending on the questions asked. While “interpretivist” and “qualitative” research should not be considered as synonymous (Munkvold & Bygstad, 2016), this research comprises an interpretive, qualitative study. Qualitative research implies that data are analyzed in an iterative way so that the researcher can make sense of them (Munkvold & Bygstad, 2016).

While quantitative research tends to adopt a deductive approach and tests a theory, qualitative research is more often inductive and process-oriented and generates or refines a theory (Bryman, 2012; Dennis & Valacich, 2001).

The stages of the research project are shown in Figure 2.

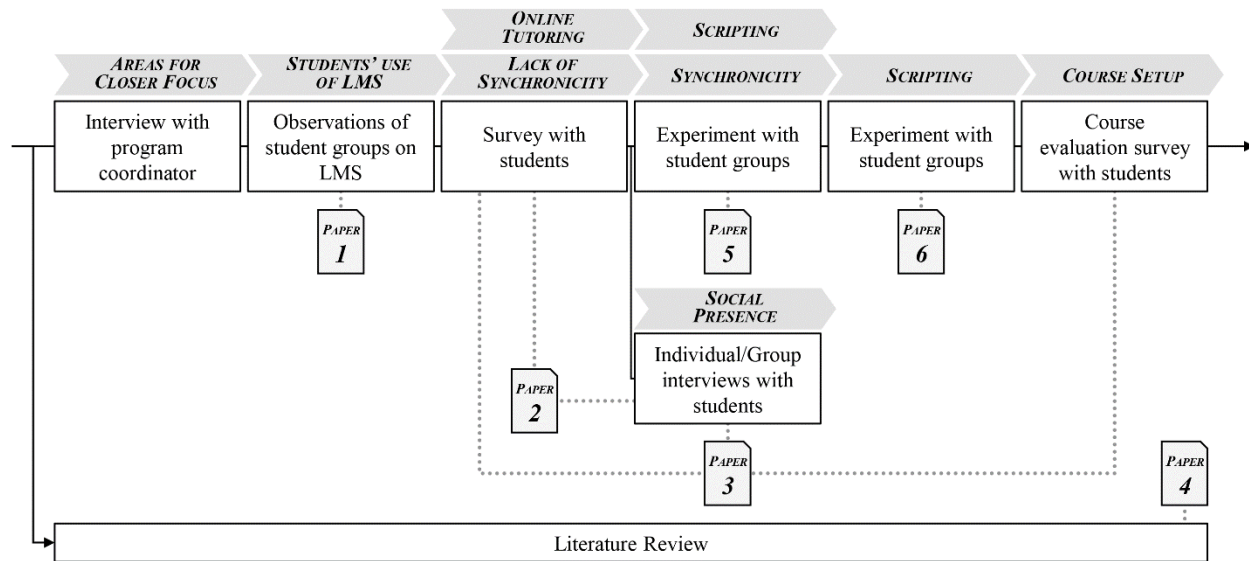


Figure 2. Data collection methods used in the research project (white boxes), focus areas for each data collection activity (gray arrows), and mapping of thesis publications.

As seen in Figure 2, the results of each step fed into the following research activities. Thus, the conclusions from each stage of the project had an impact on the framing of the following studies. In this section, I explicate in more detail how the work on the project unfolded.

The research began with observations of current CSCL practices in the Faculty of Social Sciences at the University of Agder. I started out by interviewing an international online Master’s degree program coordinator. This program focused on the issues of sustainable development in the context of developing countries and involved international participants with varying cultural backgrounds. The students following the program had a two-week face-to-face session prior to starting the learning activities online. The second face-to-face session took place at the end of the second semester and lasted approximately three weeks. After the second face-to-face session, the rest of the coursework was again carried out in an online format. The online part of the program was run on the university LMS (Fronter). The Fronter LMS provided a standard set of affordances, similar to state-

of-the-art LMS such as Blackboard. For example, it included the opportunity to download and upload files of different formats, interact with classmates and online tutors by posting messages in the forum, create and edit text documents collaboratively, submit individual and group deliverables, and take quizzes created by the course instructors. The students participated in the learning activities asynchronously, posting their text-based contributions in the corresponding group forums.

The interview provided preliminary ideas in terms of potential foci for narrowing down the further investigations, supplementing those that I had identified in the project proposal. The program had been running successfully for seven years, and therefore the interview was targeted at learning about the successful CSCL strategies that had been implemented. The role of the online tutors was emphasized as being central to the whole online program. Moreover, the two-week face-to-face session was described as a significant precondition for the students to be able to follow the program successfully. I was also interested in the areas where improvements might be needed. The main weakness brought up by the program coordinator was that some of the students experienced challenges when collaborating in groups, even though generally the students did not experience any major difficulties communicating with each other and the tutors.

My next step was to carry out observations of asynchronous student discussions on the university LMS in order to describe the successful CSCL practices adopted in the program and identify weak points. I followed a group of four students in two courses run in the second semester of the online Master's degree program described above. Two of the students were from a European country, while the other two came from Asia and Africa. The students were supported by two online tutors (one tutor per course), and there were three course instructors who intervened in the discussions sporadically. As a neutral observer, I did not intervene in the learning process at any point. The participants of the study were informed about the observations and provided their formal agreement to be observed. The observations were carried out to learn more about the students' strategies for managing online discussions and organizing their learning process. Moreover, special attention was paid to the role of the online tutors and the medium (the LMS) in the student discussions.

In terms of the findings, which will be addressed in more detail in Chapters 5 and 6, the observations of current practices provided empirical evidence for the importance of the

online tutors' role in the students' collaborative learning. As a result, my following research step focused on the investigation of the role of the online tutor. The data were collected from students taking a one-year online collaborative learning course. The course was offered to students following a Master's degree program in multimedia, education, and technology at the University of Agder. The program was mainly offered in a face-to-face format, with this being the only course that was run online. In addition, the course was offered to teaching staff in two partner universities located in Africa and Asia. The course focused on issues of online pedagogy and the design of online courses. The general setup of the course was the same as that for the online Master's degree program described above. The main difference was that instead of being an external observer, I performed the role of the online tutor. This allowed me to analyze this role from different perspectives: the student perspective and (as an involved researcher) the online tutor's perspective.

After the first semester, I carried out an online survey with the course participants (N=14). This was followed up by short individual interviews (N=9) with the participants after the second semester. In addition to the individual interviews, a focus group interview (N=14) was carried out with the course participants based in the partner university in Africa during a field trip there. This phase of the project was essential for outlining the role of the online tutor in establishing social presence among the students in asynchronous learning environments. It also enabled me to formulate a range of practical guidelines for online tutors. As I continued working with the course in the following year, I was able to collect more student insights from an informal course evaluation survey (N=9). These empirical data, together with my observations and experiences as an online tutor, served as a good basis for formulating a conceptual understanding of how to combine collaboration scripting and online tutoring to support online collaborative learning.

As the project progressed, the lack of synchronicity in student collaborative interactions suggested several implications for further work in terms of addressing the transactivity of these interactions. It was concluded that the lack of synchronicity often resulted in more scattered student contributions, with students often failing to relate to messages posted previously by their peers. Thus, two further studies were designed that focused on the implementation of collaboration scripts. Both studies followed an experimental design, guided by the dominant research approach in the literature on collaboration scripting.

The first study was carried out during a Bachelor's degree course on information and communication technologies (ICT) and learning, for which I was invited to be a guest lecturer. Although all the participating students were based in the university campus in Kristiansand (unlike the previous data collection settings), the course combined face-to-face and technology-mediated teaching. The session in which the data were collected was run online using Google Docs as the main platform for collaboration. During this session, the participants were working synchronously. Nearly half of the groups were scripted, and the other half were not. The learning activity of two control (unscripted) and three treatment (scripted) groups (total number of participants, N=25) was analyzed. It was expected that the synchronous form of communication would contribute to a general increase in the transactivity of student interactions. The collaboration script aimed to enhance knowledge interdependence and facilitate revision processes, thereby reducing coordination effort and prompting more contribution behavior.

To carry out the second study, I returned to the one-year online course in which I was involved as an online tutor. The study investigated collaboration script application in the context of asynchronous discussions. Knowing that the asynchronous mode of interaction tends to decrease the transactivity of student interactions, I focused on designing a collaboration script that would facilitate role division among group members working on a one-week learning assignment. The roles were designed to encourage students to explicitly relate to their peers' earlier contributions in a meaningful way. Four groups were scripted, and their results were compared with those of six unscripted groups that had followed the course in the previous year (total number of participants, N=51).

During the whole process, I continued to work on reviewing and synthesizing the literature, which was informing the empirical data collection. The outcome of the dissertation is a set of guidelines on online tutoring and collaboration scripting that can be used and implemented by practitioners in similar settings. Moreover, the findings have the potential to contribute to existing theories and methodological developments. Table 4 summarizes the data collection methods and explicates the purpose of each step.

Table 4. Methods of data collection applied in the project

Data collection	Context	Purpose
Interview with study coordinator (Fall 2014)	International online Master's degree program focusing on issues of sustainable development in the context of developing countries.	<ul style="list-style-type: none"> — Identify areas related to CSCL practices for closer examination — Identify successful CSCL strategies implemented in the program — Identify weaknesses of the CSCL practices in the program
Observations of collaborative learning activity on the LMS (Spring 2015)	A group of four students supported by two tutors and three course instructors, who were followed throughout two online collaborative courses run on the university LMS as part of the program described above.	<ul style="list-style-type: none"> — Describe student strategies for managing online collaborative learning discussions — Describe the role of the online tutor in students' collaborative interactions — Describe the impact of the LMS affordances on student collaboration — Identify areas for improvement in the CSCL environment
Survey with students (Fall 2015)	One-year online collaborative learning course run on the university LMS as part of a Master's degree program specializing in multimedia, education, and technology (N=14).	<ul style="list-style-type: none"> — Understand student perspectives on online tutoring — Understand the impact of the LMS on student collaboration
Experimental design involving transcripts of student discussions, chat logs, blog reflections, and group deliverables (Spring 2016)	One session in a Bachelor's degree course on ICT and learning. The learning activity was run on the Google Docs platform. Two control (unscripted) and three treatment (scripted) groups (total N=25).	<ul style="list-style-type: none"> — Understand the effects of scripting on the quality of student interactions — Understand the impact of synchronicity on student collaboration

Table 4. Methods of data collection applied in the project (continued)

Data collection	Context	Purpose
Focus group interview with students from the partner university in Africa (Spring 2016)	One-year online collaborative learning course run on the university LMS as part of a Master's degree program specializing in multimedia, education, and technology. Representatives of two student cohorts participated (N=14).	<ul style="list-style-type: none"> — Obtain a better understanding of issues of social presence in an asynchronous learning environment — Obtain a better understanding of the impact of the LMS on student collaboration
Individual short interviews with students (Spring 2016)	One-year online collaborative learning course run on the university LMS as part of a Master's degree program specializing in multimedia, education, and technology (N=9).	<ul style="list-style-type: none"> — Obtain a better understanding of issues of social presence in an asynchronous learning environment — Obtain a better understanding of the impact of the LMS on student collaboration
Experimental design involving transcripts of student discussions and group deliverables (Fall 2015–Fall 2016)	One-year online collaborative learning course run on the university LMS as part of a Master's degree program specializing in multimedia, education, and technology. Four experimental groups (scripted) were compared with six control groups (unscripted) that had followed the course in the previous year (total N=51).	<ul style="list-style-type: none"> — Understand the effect of scripted roles on the transactivity of student discussions
Course evaluation survey with students (Spring 2017)	One-year online collaborative learning course run on the university LMS as part of a Master's degree program specializing in multimedia, education, and technology (N=9).	<ul style="list-style-type: none"> — Collect student feedback on the general course setup

In the rest of this section, I discuss each of the data collection methods in more detail.

4.2.1 Observations

To carry out the observations of the student asynchronous discussions, I was granted access to the course forums on the university LMS. I did not interact with the students or interfere with their discussions, although they were informed about the purpose of my presence and agreed to participate in the research.

The purpose of the observations was to identify and describe the successful CSCL practices present in the online Master's degree program. Thus, I focused on (1) the role of the online tutor in guiding student discussions, (2) student strategies for organizing and managing online collaborative interactions, and (3) the potential impact of the LMS on the flow of interactions in the environment. The observations lasted around three months. During this period, the students produced 297 messages, the course instructors 49 messages, and the online tutors 68 messages. Interaction analysis (IA; Jordan & Henderson, 1995) was applied to analyze the interactions on the LMS, with the analysis focusing on aspects of interaction such as the structure of events, the temporal organization of activity, turn taking, trouble and repair, and participation structures. The issues related to IA are discussed further in Section 4.3.2. The analysis of the observations is reported in the first paper of this thesis (Lazareva, 2015b; see Appendix 11).

4.2.2 Interviews

Both individual interviews and one focus group interview were conducted. These interviews were targeted at understanding the perceptions of the research participants. If the interviewer directs the process of the interview too much and is not open to listening to the interviewee's own (perhaps additional) insights in addition to the questions posed, this may lead to the data losing their richness. At the same time, being too passive may lead the participants to think that the researcher is not interested in listening to their views or make them doubt the researcher's professionalism and knowledge (Walsham, 1995). Thus, all the interviews were semi-structured and based around key questions formulated in an interview guide. Mirroring techniques were applied to focus on the participants' perceptions of the online learning environment as well as motivational issues (Myers & Newman, 2006). Interviewing people with varying roles helped represent different voices within this context (Myers & Newman, 2006).

The first interview was carried out with the international Master's degree program coordinator in Fall 2014. The interview lasted approximately one hour. No recording

devices were used, and the key points of the conversation were instantly manually transcribed. The interview guide can be found in Appendix 2. The aim of the interview was to gain a better understanding of the context of the online program and identify its strengths and weaknesses in terms of the technological platform (through student feedback on the LMS and any complementary tools) and the teaching strategies supporting the collaborative learning approach used (e.g., choice of learning assignments, guidance provided to the student groups, and assessment methods).

Next, a focus group interview was carried out with students on the one-year online collaborative learning course. This was carried out on a field trip to the partner university in Africa in Spring 2016. Fourteen participants took part in the interview, and students from two cohorts (academic year 2014–2015 and academic year 2015–2016) of the course were represented. The interview lasted approximately 1.5 hours and was video-recorded. Additional insights and thoughts were jotted down immediately after the interview. The focus group interview guide can be found in Appendix 3.

After the focus group interview was conducted, I carried out short interviews with nine individual students that had agreed to participate. These nine participants were representatives of the same cohort (academic year 2015–2016) of the course. Five African participants were approached. The questions were selected from a prepared set (see Appendix 4), and the choice of questions varied based on the insights that each individual participant had shared during the focus group interview. After returning to Norway, I approached four local students for a similar short individual interview. The same set of questions was used as a point of departure. Since I was not aiming to compare the answers of different participants to the same questions, seeking instead to gain a better understanding of each individual perspective, I started with questions of a broader character, letting the interviewees elaborate more on matters they considered important. These short interviews were recorded using a voice recorder. The interviews ranged from 9 to 22 minutes. The interview guide can be found in Appendix 4. The insights obtained through the focus group and the individual short interviews with students are reported in Papers 2 (Lazareva, 2017a) and 3 (Lazareva, 2017b) of this thesis (see Appendix 11).

Qualitative content analysis was employed to analyze the data collected through the interviews. This is described in more detail in Section 4.3.2.

4.2.3 Survey

A new survey tool was developed (see Appendix 5), guided by the research literature. What follows is a brief review of the aspects that were considered when developing the survey.

According to Oppenheim (1992), in developing a survey, researchers should come up with a list of hypotheses and single out the variables to be measured (in this case, students' perceptions). To identify the critical issues, I used the field notes I had been taking while teaching the course. In addition, some background literature was used to address certain aspects of online tutoring: the provision of social presence (Sung & Mayer, 2012; Remesal & Colomina, 2013), the provision of feedback (Coll, Rochera, & de Gispert, 2014), and the roles and processes supposed to be supported by the tutor (Berge, 1995; Denis, Watland, Pirotte, & Verday, 2004; Goold et al., 2010; Kopp et al., 2012). Since the role of the platform used was very important, part of the survey dealt with the LMS.

The survey questions were kept as short as possible and avoided using two different verbs or concepts. Negative questions were excluded to avoid confusion. The grammar used in the questions was simplified (e.g., by using the active rather than passive voice) to reduce the cognitive demand on the respondents. No overly complicated academic vocabulary was used in the questions to prevent the respondents from choosing a socially desirable answer in the case of hesitation. Instead of using words of frequency (e.g., "often"), which may mean different things to different people, I used ranges (Lietz, 2010).

The questions were constructed under the guidance of my supervisors and discussed and agreed with the course instructor. The invitation to participate was presented to the students separately, prior to the actual questionnaire (Andrews, Nonnecke, & Preece, 2003), and a reminder was sent after two weeks. The survey was administered online using the SurveyXact platform. In addition to enabling us to reach students residing outside of the university campus in Kristiansand, the online questionnaire provided a range of advantages. For example, online questionnaires can present questions in multiple formats. Also, the questions are required to be answered in a specific order, and the respondent cannot skip anything or look to the end of the document (Evans & Mathur, 2005).

However, since there is no human available to assist in the case of difficulties or ambiguities, some people give up on filling out questionnaires (Evans & Mathur, 2005). Since an online survey does not allow the participants to look ahead to upcoming questions, it may seem that the questionnaire is endless. Therefore, a graphical progress indicator was displayed, starting from the first page of the survey (Evans & Mathur, 2005). With respect to the presentation of questions, there are controversial opinions on how many points there should be on a Likert scale or a semantic differential scale. In general, it has been suggested that five points should be used for “agree or disagree” questions, while seven points should be used for questions implying more subtle judgments (Lietz, 2010).

The order of the questions is also important. Thus, general questions in the survey preceded more specific ones. Moreover, the questions were organized under sub-topics, and each topic included a small introduction (Lietz, 2010). The questions on the students’ background information were placed at the beginning of the survey to create an atmosphere of trust between the researcher and the respondents (Andrews et al., 2003).

The survey was administered at the end of the Fall Semester 2015 for the students taking the one-year online collaborative learning course on issues of e-pedagogy. Out of the 31 students following the course, a sample of 14 completed the survey. Although the response rate was rather low, the participants who completed the survey provided valuable and detailed insights into the role of the online tutor in online collaborative learning. The data obtained through the student survey are reported in Papers 2 (Lazareva, 2017a) and 3 (Lazareva, 2017b) of this thesis.

Qualitative content analysis was employed to analyze the data collected through the survey. Section 4.3.2 focuses on this data analysis technique in more detail.

At the start of Spring Semester 2017, an informal course evaluation survey was conducted with the new cohort of students following the same course. SurveyXact was used to deliver the survey. The survey included eight open-ended questions (see Appendix 6). The survey questions were constructed by myself, the course instructor, and the other online tutor. The questions were rather general, and the aim of the survey was to get student feedback on the course setup based on their experience from the first part of the course (Fall Semester 2016). Nine students (out of 18 students following the course) completed the survey. The results of this survey were used to provide additional insights

for the conceptual discussion on combining collaboration scripting with online tutoring to support online collaborative learning. These results are included in Paper 3 of this thesis (Lazareva, 2017b).

4.2.4 Experimental Design

Two experimental studies were carried out during this project, focusing on the implementation and effects of collaboration scripting. Experimental design is typical in research on collaboration scripts, as can be seen from the body of empirical research on this topic (Bouyias & Demetriadis, 2012; Kollar et al., 2007; Noroozi et al., 2013; Popov, Biemans, et al., 2014; Raes et al., 2016; Stegmann et al., 2007; Wecker et al., 2010; Weinberger et al., 2005; Wichmann & Rummel, 2013).

Some studies compare the effectiveness of collaboration scripts with other kinds of instructional support, such as providing a model for students to observe (Rummel & Spada, 2005). However, most empirical research on collaboration scripts follows an experimental or quasi-experimental design, which means that in at least one experimental condition the collaborating learners are supported by a script, while in at least one control condition the learners collaborate without being supported by a script (Vogel, Wecker et al., 2016).

Most of the experimental studies on collaboration scripting that I have built on provide statistical analyses of the data but do not report on the learning processes in the groups participating in the study (Kollar et al., 2007; Noroozi et al., 2013; Stegmann et al., 2007; Wecker et al., 2010; Weinberger et al., 2005; Wichmann & Rummel, 2013). Some of the studies combine a statistical approach with a qualitative analysis in which they describe how the learning process develops in groups (Popov, Biemans et al., 2014; Raes et al., 2016). Much of this research on collaboration scripting also uses pre- and post-test measures (Kollar et al., 2007; Noroozi et al., 2013; Raes et al., 2016; Stegmann et al., 2007; Wecker et al., 2010; Weinberger et al., 2005).

The studies on collaboration scripting are presented in Papers 4 (Lazareva, 2017c) and 6 (Lazareva, under review) of this thesis. Both papers provide detailed descriptions of the experimental design of the studies. Although an experimental design was employed, I have chosen to use qualitative data analysis techniques to approach the data. Qualitative content analysis was employed to describe the quality of the student interactions during

the collaborative learning discourse (see Section 4.3.3 for more on the qualitative content analysis technique). Thus, descriptive statistics were used to provide an overview of the quality of group interactions. Moreover, the limited number of participants in both studies allowed me to follow the processes in each of the participating groups in closer detail, which has brought a deeper understanding of the factors that may affect collaborative learning in groups, rather than placing the focus on individual learning in the group context.

4.3 Data Analysis

4.3.1 Interaction Analysis

Observations of students' interactions and contributions can demonstrate what is happening in the process of CSCL. Moreover, observations can help identify which affordances are used most, which are not perceived, and which are missing but desirable. Observations can also help describe the strategies that are useful for supporting online collaborative interactions.

I have chosen IA as the key method for analyzing the interaction data collected during the observations. IA is “an interdisciplinary method for the empirical investigation of the interaction of human beings with each other and with objects in their environment” (Jordan & Henderson, 1995, p. 39). This type of analysis, unlike conversation analysis, focuses not only on talk but also on non-verbal actions, such as use of artifacts and technologies. One of the goals of IA is to “identify regularities in the ways in which participants utilize the resources of the complex social and material world of actors and objects within which they operate” (Jordan & Henderson, 1995, p. 41).

Topical issues for IA are based around the ways in which people perceive each other's actions as meaningful and projectable. From the point of view of IA, learning is a distributed social process, and it is important to understand the ways in which people learn collaboratively (Jordan & Henderson, 1995). Thus, IA is a helpful technique for understanding complex communication processes on a deeper level. The key foci adopted during the analysis are described below (based on Jordan & Henderson, 1995).

Structure of events. “Events” can be described as stretches of interaction that cohere in a meaningful way for their participants. All human activity is bunched into events (e.g., a lecture or a dinner). For IA, smaller episodes are identified (e.g., checking homework or

serving coffee). Each event has a structure—usually quite complex—that involves at least a beginning and an ending, which are especially interesting for IA because this is when significant interactions tend to happen. Beginnings and endings are often characterized by the reorganization of artifacts.

It is important to understand how participants make structure visible to themselves and each other, marking the boundaries and proceeding from one stretch of interaction to the next. The transitions from one segment to another may be seamless or, on the contrary, very unsmooth. The latter can happen when, for example, there is a lack of successful negotiation of turn taking. Most of learning activities imply a known and expected pattern of events; in collaborative learning, it is important that participants achieve the ability to carry out transitions in a meaningful and projectable way for everyone.

Temporal organization of activity. IA addresses the rhythmicity or periodicity of human activities. Analytical interest here lies in understanding how repetitive sequences form stable routines that are helpful in managing potential flaws in communication. IA is interested in both routinized aspects of activity patterns and their variations. In collaborative learning situations, periodicity can be triggered by the features of the task, as when there is a series of assignments and problems to solve.

Generally, in educational settings, temporal structuring is provided by the course schedule, but a lot of important work and events happen in the space between actual classes or lectures. Therefore, understanding the temporal organization of activities in formal educational contexts can help identify resources and constraints for designing learning environments that promote learning.

Turn taking. Often, in formal educational settings, the rules for turn taking are ritualized and dictated by the teacher. The teacher speaks and then requests individual students to respond. Students follow the pattern; otherwise, the situation is disruptive because the sequence of activities planned by the teacher is ruined. From this point of view, students have quite a passive role. This is not supposed to be the case in CSCL, where students should be able to establish their own routines of turn taking that can contribute to the effective management of the collaboration.

Participation structures. IA investigates the extent to which individuals orient themselves toward a common task and have shared attention and mutual engagement. IA

helps us to understand how participants make their (dis)engagement visible to each other, what strategies they use, and how artifacts and technologies can support or constrain the participation structures.

Trouble and repair. It is important to analyze those episodes where the normal stream of activity is broken in one way or another. Such an analysis can often reveal certain as yet undiscovered rules that people use in organizing their lives. In addition, the analysis of troubles can help us understand the constraints in the material world that may be a routine reason for this trouble.

Spatial organization of activity. The way the material world is organized can facilitate certain uses of space and make other uses difficult. The ways in which space is occupied, interactions are handled, and objects are used depend on socially recognized situations and expectations. Much depends on who owns the territory in which the interaction takes place.

Artifacts and documents. Often, artifacts constitute the focus of interaction; therefore, it is important to include these in the analysis. Even if they are not the key focus, artifacts can have other functions. For example, in the process of the joint construction of a collaborative essay, students can monitor that they agree with each other regarding the understanding of concepts.

Table 5 suggests some examples of tendencies that can be identified with the help of interaction analysis.

The first paper of this thesis (Lazareva, 2015b) reports on the interaction analysis of the students' collaborative learning interactions and its implications).

Table 5. Interaction analysis foci applied in the observations of CSCL practices

IA focus	Example
Structure of events	<ul style="list-style-type: none"> — Peer informs the group about his or her absence / the time the contribution can be expected. — Peer creates separate threads for each of the sub-questions of the task.
Temporal organization of activity	<ul style="list-style-type: none"> — Tutor creates a new thread to remind students of an upcoming deadline.
Turn taking	<ul style="list-style-type: none"> — Student explicitly addresses a peer who has not yet provided his or her contribution. — Student follows a discussion pointer provided by the online tutor.
Participation structures	<ul style="list-style-type: none"> — Student uses explicit indicators of his or her emotions (e.g., emoticons or peculiar punctuation).
Trouble and repair	<ul style="list-style-type: none"> — Trouble may occur when two peers post a similar contribution / express similar interest at approximately the same time without noticing the contribution of the other.
Spatial organization of activity	<ul style="list-style-type: none"> — Not many off-task social interactions happen on the LMS.
Artifacts and documents	<ul style="list-style-type: none"> — Students prefer an alternative platform for collaborative essay writing even though the LMS offers a collaborative text editor.

4.3.2 Qualitative Content Analysis

Employing quantitative methods alone may reduce the accuracy of an analysis due to the lack of attention paid to the qualitative dimensions (Kracauer, 1952). For example, when using quantitative methods, the data may become decontextualized (Forman & Damschroder, 2008). Qualitative content analysis is “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005, p. 1278). This method is designed to obtain a condensed description of a phenomenon through the application of descriptive categories (Elo & Kyngäs, 2007).

Qualitative content analysis can be both deductive and inductive, and the choice of approach depends on the purpose of the study (Elo & Kyngäs, 2007). Deductive content analysis is applied to test or conceptually extend an existing theory. An advantage of this approach is that the existing theory helps the researcher to narrow down the focus. On the other hand, theory-led questions may manipulate the participants’ answers. Moreover, the

researcher may fail to recognize important contextual aspects of the phenomenon due to the limits set by the applied theory (Hseih & Shannon, 2005). Inductive content analysis is applied to explore phenomena that have not been studied previously or where the current knowledge and theory about them is fragmented (Elo & Kyngäs, 2007; Hseih & Shannon, 2005). The main aim of qualitative inquiry is to understand a phenomenon rather than draw generalizations (Forman & Damschroder, 2008), and few or no expectations are required prior to the process of data analysis (Strijbos, Martens, Prins, & Jochems, 2006). The researcher lets the categories flow from the data, which makes it possible to obtain a rich understanding of the phenomenon. Thus, the strength of this approach is that the researcher is able to learn from the participants without imposing predefined categories on them (Hseih & Shannon, 2005). Inductive content analysis can be challenging as the lack of theory informing the analysis may result in either too many categories or a small set of categories that are too generic.

Content analysis was applied in this research study to analyze the data collected through the student survey, the focus group interview, and short individual student interviews. In this case, existing research on online tutoring and social presence served as a framework for approaching the data in a systematic way (Berge, 1995; Kopp et al., 2012; Sung & Mayer, 2012). The results are presented in Papers 2 (Lazareva, 2017a) and 3 (Lazareva, 2017b) of this thesis. Due to page limitations, the procedure of the analysis was not able to be presented in detail in these papers.

Content analysis was also applied to analyze the student contributions produced in collaborative learning situations. The results of the analysis are presented in Papers 4 (Lazareva, 2017c) and 6 (Lazareva, under review) of this thesis. Again, due to page limitations, not much detail on the procedure of the analysis was provided in Paper 4 (Lazareva, 2017c). However, Paper 6 (Lazareva, under review) is more detailed when it comes to the description of the methodology. Both experimental studies used a similar approach. What follows is an explication of the qualitative content analysis method used in the different studies that make up this research project.

There are three main phases in this process: preparing, organizing, and reporting (Elo & Kyngäs, 2007). Similarly, Forman and Damschroder (2008) discuss the stages of immersion, reduction, and interpretation.

To ensure immersion, it is important for the researcher to record his or her initial impressions immediately after the data collection, as well as collecting notes and memos during the data collection (Forman & Damschroder, 2008). It is extremely important to develop a broader understanding of the data in order to avoid failing to identify the key categories (Elo et al., 2014). This was especially relevant for the synchronous session carried out on Google Docs (Lazareva, 2017c) and the focus group and short individual interviews (Lazareva, 2017a; Lazareva, 2017b). In the former, there were seven groups collaborating simultaneously, and I took notes as I observed how the work progressed in each of the groups. These notes were of vital importance when later analyzing and reflecting on the learning process in each of the groups. In the case of the focus group and short individual interviews, I took notes immediately after conducting each interview to capture my personal observations. The second experimental study was carried out in the asynchronous mode (Lazareva, under review). Therefore, the preparation phase required some reflection notes that were taken as the scripted groups were progressing toward their final goal. These notes were especially useful for later reflecting on the flaws of collaboration scripting.

To reduce the data, it was necessary to develop a structured approach, reorganizing the data with the help of codes. Code definitions should not overlap in meaning. When interpreting the data and drawing conclusions, it is important to go back into the data to find specific evidence supporting the conclusions (Forman & Damschroder, 2008). In the studies reported in this dissertation, I have chosen to employ deductive content analysis. This means that I selected existing coding frameworks for organizing and describing the data. The analysis of the survey and interview data was guided by earlier research on online tutoring and social presence (Berge, 1995; Kopp et al., 2012; Sung & Mayer, 2012). As a result, I did not revise the existing concepts or categories but rather provided a deeper explanation and description of them. For example, some of the collected data were related to the cultural background of the participants. However, instead of formulating a new category, I discussed these data within the existing conceptual framework, which did not focus on cultural issues explicitly.

In the case of both experimental studies, the frameworks were revised during the data analysis based on the novel insights obtained from the original data, removing and/or adding new categories. The framework of Curtis and Lawson (2001) was used to analyze

the synchronous collaborative learning situation (Lazareva, 2017c). The revised coding scheme, including examples from the original data, can be found in Appendix 7. The framework of Gunawardena, Lowe, and Anderson (1997) was used to analyze the asynchronous collaborative learning assignment (Lazareva, under review). The revised coding scheme can be found in Appendix 8. During the data analysis, I was able to provide a more detailed elaboration of each category than is found in earlier research.

One of the main challenges of this kind of analysis is that there is no specific correct way to do it. Qualitative analysis is subjective, and the same topic may have different plausible qualitative interpretations (Kracauer, 1952). Therefore, it is important to report in detail not only on the results but also on the process of analysis. Authentic citations can be used to improve trustworthiness (Elo & Kyngäs, 2007). Thus, I included student quotations in the papers to document the data (Lazareva, 2017a; Lazareva, 2017b; Lazareva, 2017c). Moreover, it is important that researchers are explicit about describing the choices made during the development of the coding procedure (Elo et al., 2014; Strijbos et al., 2006). Indeed, identifying a suitable unit of analysis is one of the key issues in ensuring trustworthiness (Elo et al., 2014). Thus, the final paper of this thesis, which describes the results of the experiment carried out in the asynchronous learning environment (Lazareva, under review), is largely focused on the trustworthiness of the content analysis technique and provides much detail regarding the data analysis procedure.

4.4 Quality Criteria

One of the most common mistakes when evaluating the quality of an interpretivist study is to apply the same validation criteria as for positivist studies (Munkvold & Bygstad, 2016). While it is not possible to apply a pre-determined set of criteria in a mechanistic way to evaluate the quality of an interpretivist study, this does not imply that there are no standards by which interpretivist research can be judged (Klein & Myers, 1999). Earlier research has formulated definite sets of criteria for judging the quality of an interpretivist inquiry (Guba & Lincoln, 1994; Klein & Myers, 1999). The principles of Klein and Myers (1999) for evaluating interpretive field studies have been applied to assess this research project (see Table 6).

Table 6. Assessing the quality of the research project

Principle	Goal	Examples of how this was addressed
(1) The fundamental principle of the hermeneutic circle	Iterative interpretation of the separate meanings of the parts and the whole they constitute	— Analyzing individual student messages to understand the character of the learning process as a whole
(2) The principle of contextualization	Reflection on the social and historical background of the research setting	— Considering participants' background and experience in collaboration — Being explicit in the description of the context and method — Including direct student quotations in research publications
(3) The principle of interaction between the researchers and the subjects	Reflection on how the data were constructed through the interaction between the researcher and the participants	— Collecting student insights through surveys, interviews, and reflections — Challenging the researcher's current understanding of the phenomena through the student perspectives
(4) The principle of abstraction and generalization	Application of Principles 1 and 2 to the general theoretical understanding of the phenomenon under study (in light of the findings revealed by the data)	— Approaching the results from different theoretical lenses — Discussing the findings with colleagues in research seminars, workshops, and conferences
(5) The principle of dialogical reasoning	Sensitivity to potential contradictions between the existing theory guiding the research design and the findings	— Modifying coding schemes according to the data that emerged
(6) The principle of multiple interpretations	Sensitivity to possible differences in interpretations among study participants	— Considering differences in students' perspectives on the same matter
(7) The principle of suspicion	Sensitivity to possible biases and distortions in participants' interpretations	— Using observations and field notes in addition to the participants' insights

The principle of the hermeneutic cycle is fundamental and can be considered a meta-principle on which the other principles build (Klein & Myers, 1999). The application of the sequential multimethod approach in this project implies that the progression of the project was guided not only by existing theories but also by my own findings in light of the applied theories. Thus, there was a constant iteration between the current understanding of the phenomena under study, the interpretation of the new empirical findings, and the design of the following steps of the project. Moreover, being part of the faculty and engaged in teaching activities provided me with opportunities to keep revising my findings through discussions with colleagues and students.

4.5 Limitations of the Research Design

The research design of this project was limited by practical considerations, especially in terms of access to potentially relevant contexts for data collection. As described in the problem statement in Section 1.1, the research focused on practices at the University of Agder. It was important for me to select data collection settings in which the collaboration component was designed as an integral part of the course. This allowed for the investigation of collaborative learning processes in an authentic context.

Not many courses in the online/blended learning mode were offered at this university at the time of data collection. With the help of my supervisors I was able to identify potentially relevant online courses run in collaboration with a partner university in the USA. However, those courses were lacking the collaborative learning component, thus not being suitable for the goals of this research project. In addition, I was invited as an observer to a massive open online course (MOOC) at the University of Agder. Although some of the course activities were designed to be carried out in groups, the mode of the course caused a different character of group dynamics which was not suitable for a deep analysis of small group collaboration. Therefore, I was limited to use the contexts that were available. Most of the empirical data collection efforts were focused on the online Master's degree program and the one-year online collaborative learning course offered by the university (see Section 4.2) where the collaborative learning approach was implemented. This reduced variation in terms of the technological settings, as the university LMS (Fronter) was used in both these courses. However, I managed to identify another course where organizing a single session in the computer-supported collaborative mode was practically and thematically possible, and I used this opportunity to collect

more data in a different setting. Google Docs was used as a platform for synchronous collaborative writing. While this introduced some technological variety, I acknowledge that the different duration of the studies in the asynchronous and synchronous settings represents a limitation with respect to the comparison of these studies.

Another possible limitation is related to my role as an online tutor in the one-year online collaborative learning course (see Section 4.1.1 for more details). Finally, ethical concerns also provided some limitations. This is discussed in more detail in the following section.

4.6 Ethical Issues

Ethical concerns also limited the collection and use of data in several aspects. In the case of the two courses in the online Master's degree program, informed consent was collected from the students, who agreed to participate in the observations at the beginning of the research project. This was somewhat complicated to obtain as the potential participants were not physically accessible. As a result, only a limited number of forms were signed and returned. As the observations focused on the collaboration practices, it was necessary that all the participants in the small groups provide their consent. Thus, only two groups could be observed at this stage of the project.

To avoid similar consequences in the further studies, other principles were appropriated. The participants were informed that their survey responses would be treated anonymously and confidentially and that it would not be possible to link the responses to individual persons. The participants were strongly encouraged to participate, although the participation was voluntary. In the case of the individual and focus group interviews, the participation was also on a voluntary basis. I confirmed with each participant that he or she agreed to the interview being video- or audio-recorded. It was also mentioned that the recording could be stopped at any moment if the interviewee so wished. The recorded data were deleted after being transcribed. These strategies explain the somewhat larger number of participants at this stage of the research.

Finally, toward the end of the research project, the focus was on the detailed analysis of the learning process in the student groups, and the two experimental studies were carried out. In these studies, it was especially important to have a larger number of students participating to be able to compare the scripted and unscripted groups. In the case of the

collaborative writing activity in Google Docs, the assignment was presented in the course as a thematically relevant learning task. The participation was voluntary but highly encouraged. The students were informed that their activity was going to be included in a research project focusing on the implementation of collaboration scripts. The participants also received an outline of the aggregated results some weeks after the learning task had been carried out. In the study of the asynchronous collaborative learning activity with scripted roles, the participants were not informed that their learning activity was being analyzed. This was for several reasons. First, the activity of the unscripted groups was retrieved from the LMS archive, as at the time I did not plan to carry out a close content analysis of this specific activity. The course instructor and I did not inform the students in the scripted condition that their learning process was analyzed, as I wanted to see natural behavior that was unaffected by knowledge of the research study. Moreover, informing groups in just one of the experimental conditions would have created an unbalance in the design. I was especially careful when reporting on the results of that study. For example, I did not include any direct student quotations in the text of the publication, and the results of the analysis were presented in an aggregated form only.

Regardless of the stage of the research project, the collected data were treated confidentially, which meant that only my supervisors and I had access to the data. All the data collected during this project were anonymized, making it impossible to connect them with individual participants. When individual student quotations or contributions were included in the text of a publication, the individual students were either given a pseudonym or a number. Moreover, the background information of the participants has only been presented in a summarized way.

5 Results

Addressing the research questions introduced in Chapter 1 has resulted in several articles published in international conference proceedings and journals. Only the papers directly addressing the research questions are included in this thesis. Table 7 presents the included articles in the chronological order of publication. However, in practice, several of the papers have been developed in parallel. The full text of the papers is presented in Appendix 11. Mirroring the cross-disciplinary nature of this research project, the publication outlets include both computer-supported education and collaborative learning (Papers 1, 2, 3, and 6) and IS (Papers 4 and 5).

Table 7. Thesis publications

(1) Lazareva, A. (2015). Promoting collaborative interactions in a learning management system. <i>Proceedings of the 2015 International Conference on Interactive Collaborative Learning (ICL)</i> , pp. 421–430. IEEE.
(2) Lazareva, A. (2017). Role of the online tutor in establishing social presence in asynchronous text-based collaborative learning environments. In M. E. Auer, D. Guralnick, & J. Uhomobhi (Eds.), <i>International Conference on Interactive Collaborative Learning</i> (pp. 128–142). Cham: Springer.
(3) Lazareva, A. (2017). A framework for small group support in online collaborative learning: Combining collaboration scripts and online tutoring. <i>Proceedings of the 9th International Conference on Computer Supported Education (CSEDU)</i> , pp. 255–262. SciTePress.
(4) Lazareva, A. (2017). Facilitating synchronous collaborative writing with a collaboration script. In N. Paspallis, M. Raspopoulos, C. Barry, M. Lang, H. Linger, & C. Schneider (Eds.), <i>Information Systems Development: Advances in Methods, Tools and Management (ISD2017 Proceedings)</i> . Larnaca: University of Central Lancashire Cyprus.
(5) Lazareva, A., & Munkvold, B. E. (2017). Facilitating collaboration: Lessons learned and mutual synergies in collaboration engineering and computer-supported collaborative learning. <i>International Journal of e-Collaboration</i> , 13(3), 22–38.
(6) Lazareva, A. (under review). Fostering transactivity in asynchronous student discussions through role scripting. Submitted to <i>Computers & Education</i> .

Papers 1 and 2 are the result of the empirical explorative work carried out at the beginning of the project and focus especially on the use of an LMS for collaborative learning, as well as the role of the online tutor in scaffolding student discussions. Papers 4 and 6 are focused on the implementation of collaboration scripts and report the results of the experimental work carried out in this project. Paper 3 is conceptually oriented, aimed at formulating a framework for combining collaboration scripts and online tutoring to

provide effective scaffolding for online collaborative learning. However, this paper also uses some empirical evidence to develop the discussion. Paper 5 is a review of the research on collaboration scripts and CE, emphasizing the synergies between these two areas and discussing possible points of mutual interest.

The research questions that are addressed by the various papers are presented in Table 8. The overall question of this research project is answered in Chapter 7 based on the results reported in the individual publications. This chapter presents and summarizes the publications in terms of their focus, key findings, and core contributions.

Table 8. Research questions addressed by the papers

Research Questions	Publications
SQ1: How does the asynchronous mode of interaction affect the process of online collaborative learning in the context of a university course?	1, 2, 3, 4
SQ2: How can the online tutor contribute to building an inclusive online learning environment and promoting effective collaborative interactions among students in the context of a university course?	1, 2, 3, 6
SQ3: How can collaboration scripts promote effective online collaborative interactions among students in the context of a university course?	3, 4, 5, 6

During the project period, two more papers have been published that are related to this research project but are not included in the final thesis (Lazareva, 2015a; Lazareva, 2018). “Conceptualizing collaboration in the context of computer-supported collaborative learning” (Lazareva, 2015a) was my first paper published as a PhD candidate. This paper discusses the essence of the concept of CSCL, which is sometimes assigned different meanings. Although this paper is directly relevant to the discussion in this research project, it was published as a short paper in conference proceedings and thus does not meet the inclusion requirements of the thesis. The paper “Factors affecting student engagement in online collaborative learning courses” (Lazareva, 2018) discusses Ugandan student perspectives on what constitutes an engaging online learning environment. Its contributions include a range of practical implications for course designers and instructors with respect to eliminating the issues that can impede student engagement in learning. This paper does not specifically address the research sub-questions formulated in this thesis. However, it provides some additional insights on student engagement in online collaborative learning environments, which are considered in the discussion of the contributions of this thesis in Chapter 6.

What follows is the presentation of the six papers included in this thesis. The discussion of how the papers build on each other has been presented in Section 4.2 (see Figure 2).

5.1 Paper 1: Promoting Collaborative Interactions in a Learning Management System

Focus. The focus of this article is on the social and technological challenges in a CSCL setting. Observations of a student group (four students) supported by two online tutors and three course instructors were made in the context of two online Master's degree courses (a course on research methods and a course on the environment, development, and management) run on the university LMS. The observations lasted approximately three months, during which a total of more than 400 messages were analyzed (297 messages produced by students, 68 by online tutors, and 49 by course instructors). Interaction analysis (Jordan & Henderson, 1995) was carried out to identify tendencies in the group regarding the adoption of the technological tools and the management of the group discussions. The interaction analysis also focused on how the involvement of the online tutors and course instructors affected the flow of the student interactions. Detailed quotations and excerpts from the students' discussions are presented in the paper to illustrate interaction events such as breakages in the normal stream of activity and the establishment of norms and routines for interaction management. In addition, the paper formulates suggestions for improving the online learning environment, as well as identifying issues contributing to student engagement in learning.

Findings. The interaction analysis helped identify that the students developed a range of routines when it comes to organizing and managing their discussions. For example, organizing discussions in threads can be considered a routine that makes collaborative learners' actions projectable to one another. The role of the summarizer turned out to be the most active role, as the summarizer had the responsibility for not only compiling the final deliverable but also for organizing and monitoring the threads. The observations also showed that the students were generally eager to follow the pointers provided by the online tutors and course instructors, and such pointers tended to contribute to the transactivity of the interactions overall. Moreover, potential constraints of the LMS that could lead to flaws in student discussions were identified. For example, in the asynchronous mode, two students might post similar contributions at approximately the same time without noticing it in a timely manner. This could lead to later

misunderstandings and/or confusion in the group. Moreover, the findings demonstrate that the LMS was not sufficient for students to carry out their collaborative learning activities. Students used other tools in addition to the LMS platform, which can be explained by either a lack of the desired affordances in the LMS or by students being unaware of all the existing affordances. It is argued in the paper that student interactions can potentially be scaffolded by the implementation of collaboration scripts. From the point of view of the technology, the paper suggests that complementing such a learning platform with tools allowing for synchronous communication would be beneficial.

Contributions. This paper contributes to the understanding of student interactions in collaborative learning situations. Observations and detailed interaction analysis allowed us to follow the development of student strategies for managing learning in the group, as well as identifying specific challenges arising due to misunderstandings in communication and/or a lack of the desired affordances in the platform. The results obtained through this study and formulated in the paper are useful for informing course designers and instructors about the challenges that may arise during online collaborative learning. The study demonstrates that an interaction analysis approach can inform us about the issues unfolding during the process of collaborative interaction, which can often go unnoticed by course designers and instructors. The observations and analysis were carried out in the context of a multicultural learning group, contributing to our current understanding of cross-culturalism in online collaborative learning.

5.2 Paper 2: Role of the Online Tutor in Establishing Social Presence in Asynchronous Text-Based Collaborative Learning Environments

Focus. This paper is focused on the concept of social presence in the context of online collaborative learning. The empirical investigation was carried out in an online collaborative learning course (focusing on issues of e-pedagogy) at the Master's degree level run on the university LMS. Unlike the student group observed in the previous study, not all the students participating in this study met each other in person before starting the course, which made the issues of social presence particularly topical in this context. Two main questions are addressed in the paper: 1) How does the lack of synchronicity affect the feeling of social presence in the learning environment? 2) What strategies can an online tutor implement to promote the feeling of social presence among students taking part in asynchronous text-based collaborative learning? To answer these questions, the

students' perspectives are presented based on a survey (N=14) and follow-up interviews (N=9).

Findings. The survey revealed that students employed alternative communication media, especially those that provided the opportunity for synchronous communication. Asynchronous communication increased the chances of students feeling their text could be misinterpreted. Moreover, according to some of the students, asynchronous communication would often result in unrelated messages as some peers would post something and then disappear from the forum. In addition, it was important for the students to have an informal platform for communication in order to gain confidence about what they were going to post on the LMS for their tutor and instructor to see. Applications such as WhatsApp and Facebook Messenger were mentioned by the students. The online tutor also played a significant role in making the students feel secure about sharing ideas openly in the forum. The students recognized the online tutor's contribution in building a trustful and respectful atmosphere in the online environment. However, the students generally felt that the environment was rather impersonal and provided little opportunity for them to learn more about each other and their tutor.

Contributions. The paper discusses the affordances available in the LMS that may affect students' feeling of social presence. While the benefits of the asynchronous mode of communication in the online collaborative learning context are acknowledged, the paper focuses on the drawbacks to the lack of synchronicity, demonstrating how this lack of synchronicity may create challenges for students by inhibiting the feeling of social presence in multicultural groups. Importantly, the paper focuses on the student perspective on online tutoring and the online tutor's role in promoting the feeling of social presence in an asynchronous text-based environment. The study adds to the rather limited previous research on online tutoring and social presence. The paper advances earlier findings by suggesting a range of practical guidelines for online tutors based on original empirical data reflecting students' experiences of the course.

5.3 Paper 3: A Framework for Small Group Support in Online

Collaborative Learning: Combining Collaboration Scripts and Online Tutoring

Focus. This is a conceptually oriented paper that elaborates a framework combining collaboration scripts and online tutoring to provide students with effective scaffolding in

the context of online collaborative learning. However, the paper also builds on some empirical data collected in the context of an online collaborative learning course (focusing on issues of e-pedagogy) at the Master's degree level run on the university LMS. To present and discuss the framework, my experiences and observations as an online tutor were analyzed together with student insights collected through two surveys (N=14 and N=9) and a focus group interview (N=14). The empirical data were partially the same as the data discussed in Paper 2; however, they were expanded by the data collected through the student course evaluation survey and the focus group interview. While Paper 2 focuses on the role of the online tutor in establishing the feeling of social presence in an online collaborative learning environment, this paper discusses the interplay of the core elements of a CSCL environment. In order to understand and explain this interplay, the framework of the paper is based on the TML model (Gupta & Bostrom, 2009).

Findings. The framework suggests that meta-cognitive learning processes can be facilitated by collaboration scripts, repeatedly implemented so that students are able to internalize effective strategies. At the same time, the support provided by the online tutor should mainly target content-specific cognitive processes in students. Moreover, the role of the online tutor is highly important in ensuring a positive and open social atmosphere in the online environment.

Contributions. While collaboration scripts have shown much potential for facilitating students' general collaboration skills, the reported effects of collaboration scripts on domain-specific knowledge acquisition have been less positive. Therefore, it is necessary to identify alternative approaches for providing effective scaffolding for students. While there is research on the areas of both online tutoring and collaboration scripting, there are to my knowledge no discussions in the literature on systematically combining these two approaches. Formulating a comprehensive framework for online tutoring is an essential aspect of training online tutors to provide effective learner support in online collaborative learning contexts. Thus, the discussion of this framework has a range of implications for facilitating both domain-specific knowledge acquisition and the development of general collaboration skills in students. One of the benefits of this framework is that it is transferable to similar contexts and does not require specific software for its implementation, thus making it relevant to a wide audience of online course designers and instructors. At the same time, the discussion also points to several areas where more

research is needed, such as fostering effective collaborative interactions across cultures and implementing assessment techniques that promote positive interdependence and individual accountability in student groups.

5.4 Paper 4: Facilitating Synchronous Collaborative Writing with a Collaboration Script

Focus. This paper focuses on the investigation of the effects of a jigsaw collaboration script on the quality of the collaborative learning process and student interactions. The study employs an experimental design with two control (unscripted) and three treatment (scripted) groups (total number of participants, N=25). The experiment was carried out during one class in a Bachelor's course focusing on the use of technologies for teaching and learning. The students were assigned a collaborative writing task that they had to solve synchronously using Google Docs. The collected data included the text chat logs and the history logs from each of the five groups' Google documents, individual blog reflections written after the completion of the task, and group deliverables. The text chat logs were the main source of data, and a qualitative content analysis approach was applied. The coding scheme developed by Curtis and Lawson (2001) was used to analyze the logs. This was modified during the process of the analysis to reflect the character of the synchronous interactions (the updated version with elaborated categories and example quotations from the students can be found in Appendix 7). The paper also discusses how the learning process developed in each of the five groups, which provides implications related to the script implementation.

Findings. The results demonstrate that the scripted groups exchanged significantly more messages than the unscripted groups. For all the groups in the scripted condition, most of the chat messages were related to the planning behavior (e.g., organizing group work). By contrast, for both groups in the unscripted condition, most messages fell in the category of contributing behavior (e.g., sharing knowledge). However, the analysis of each group's process showed that not all the scripted groups followed the script systematically. The group that chose to follow the script closely had a rich discussion in which the students challenged each other constructively. However, the groups that only partly followed the script tended to settle for quick consensus building, similar to the unscripted groups. In addition, the paper discusses student perceptions of Google Docs and its affordances for collaborative writing. While reporting on the students' overall positive experiences, the

paper also points out the drawbacks discussed by the students in their blog reflections, such as the lack of advanced functionality for fine-tuning the documents and the inadequate spell checker, which may inform design considerations for these kinds of support tools.

Contributions. This paper contributes to our understanding of the effects of collaboration scripts. Closely following the process of each of the small groups allowed us to get a deeper understanding of the events occurring during students' engagement in the task. The analysis of the process in each of the groups led to the conclusion that the collaboration script increased students' cognitive load, thus resulting in greater planning and coordination in the group. Moreover, the students' increased cognitive load could be a reason for them to opt to follow only selected parts of the script. This highlights that the way that the script is written and introduced has an effect on the students' ability to follow the instructions and benefit from the effective strategies introduced in the script. Rather than focusing on individual learning in the group context, the results of the data analysis contribute to the research on collaboration scripting through the detailed insights on the learning process of each of the groups. In particular, the paper describes how collaboration scripts may affect learning interactions and, consequently, meaning making in the group.

5.5 Paper 5: Facilitating Collaboration: Lessons Learned and Mutual Synergies in Collaboration Engineering and Computer-Supported Collaborative Learning

Focus. This paper investigates possible synergies between the research in the areas of CSCL and CE. Both areas share a common goal, which is to identify the best strategies for managing interactions in collaborative groups. The paper provides an overview of the fundamental literature on collaboration scripting and CE, pointing out challenges and lessons learned and identifying several topics where the exchange of research findings would be mutually beneficial.

Findings. The literature review demonstrates that both research streams aim not only to scaffold groups in effective collaborative activities but also to help them build sustainable practices that can be executed later without external support. Both collaboration scripting and CE are concerned with providing guidance that can effectively restrict group interactions while allowing an adequate amount of flexibility for the participants to adjust

the collaboration process. The paper discusses several areas of cross-disciplinary applications. CE research can inform the collaboration scripting research on aspects such as (1) reducing students' cognitive load, (2) developing scripts for specific learning situations, (3) providing effective guidance on the use of technology, (4) specifying the role of the instructor, and (5) applying collaboration scripts in face-to-face contexts. At the same time, CE research may find the research on collaboration scripts useful in terms of (1) appropriating and internalizing effective support strategies, (2) training group participants for specific roles, and (3) applying CE in virtual settings. This paper also suggests future common research foci for the two fields. More research is needed into the design of effective guidance that is restrictive yet adequately flexible and considers both the team context and the team members.

Contributions. The research areas of CE and collaboration scripting have been developing over the past two decades. The review presented in this paper clearly demonstrates that the two streams have similar interests and challenges, including several common research foci. So far, the cross-fertilization between these two research areas has been very limited. Thus, the review and analysis in this paper provide a contribution to both research areas, suggesting how they can mutually benefit from each other's empirical findings and lessons learned.

5.6 Paper 6: Fostering Transactivity in Asynchronous Student Discussions through Role Scripting

Focus. The key focus of this paper is on the effects of a collaboration script on the transactivity of student interactions in the context of a CSCL course. The paper explores how a collaboration script potentially contributes to the quality of students' asynchronous discussions and final group deliverables. The study employs an experimental design with six control (unscripted) and four treatment (scripted) groups (total number of participants, N=51). The experiment was carried out during one group assignment in the context of an online collaborative learning course (focusing on issues of e-pedagogy) at the Master's degree level run on the university LMS. The groups had approximately ten days to discuss the assignment and produce the final deliverable. The script provided to the groups in the experimental condition focused on role distribution in the groups. It suggested assigning one member as the moderator and one member as the proposer, while the rest of the group were expected to be critics. The transcripts of the student discussions

on the LMS were the main source of data, and a qualitative content analysis approach was applied. The coding scheme developed by Gunawardena et al. (1997) and later refined by Hull and Saxon (2009) was used to analyze the transcripts. The coding scheme was modified during the process of the analysis (the updated version can be found in Appendix 8) so that clear codes were applied to all the utterances, and the coding categories were elaborated in detail. The final group deliverables were analyzed using the rubric that is normally used in the course for assessing the students' work. The paper also describes the learning process in each of the groups, which contributes to a better understanding of the collaborative learning processes and the impact of the collaboration script on them.

Findings. The results demonstrate that the students in the scripted condition produced more contributions than the unscripted students. More importantly, there were more contributions with higher levels of argumentative knowledge construction in the scripted groups. The scripted students produced more contributions aimed at reaching situated definitions and negotiating meaning. Moreover, the amount of contributions related to coordination among the scripted students was smaller than in the unscripted condition. The description of the learning process demonstrates that tutor involvement may be necessary to ensure that the script is understood and appropriated by students in an optimal way. The results also suggest that the revision phase for the final deliverable should be scripted, rather than leaving this task solely to one of the group participants.

Contributions. This paper demonstrates the effectiveness of role scripting for fostering the transactivity of student discussions in asynchronous collaborative learning in multicultural groups. As in Paper 4, the results of the data analysis presented in this paper focus on intersubjective meaning making in the group rather than describing individual learning. At the same time, the results indicate that more research is needed to investigate the role of the tutor in implementing scripts and monitoring their effects. Moreover, the paper contributes to the CSCL research from the methodological point of view. The coding scheme used for the data analysis builds on and advances earlier research in the field as the coding categories were refined and elaborated during the process of data analysis.

6 Contributions

This chapter discusses the contributions of this research project. The aim of the chapter is to articulate the practical implications for CSCL, as well as elaborating on the theoretical and methodological contributions of this research project. The focus of this thesis is on student engagement from the behavioral, emotional, and cognitive perspectives in the context of CSCL. Thus, using the three theoretical lenses (affordances, social presence, and collaboration scripting), the discussion in this chapter builds on the previous research findings in the field and advances our understanding of facilitating effective collaborative interactions among students in online learning environments. The discussion begins by addressing issues of behavioral engagement, examining the implications of synchronicity for students carrying out collaborative actions and interactions. Behavioral engagement is considered a precondition for successful participation in collaborative learning activities. To be able to engage students, online tutors need to know how the online platform and its functionality may affect students' collaboration. Next, the aspect of emotional engagement is addressed, namely, the importance of facilitating a mutually respectful environment where learners feel encouraged to engage in the process of collaborative knowledge building. Supporting emotional engagement is imperative, as if the environment is not mutually respectful and the students do not feel secure, they are unlikely to fully utilize the potential of the collaborative learning experience. The chapter then moves on to the facilitation of cognitive processes in student groups by means of collaboration scripting and online tutoring. The degree of cognitive engagement has a direct impact on students' learning outcomes as it reflects the quality and quantity of the effort that students invest in their learning.

Having discussed the practical implications, the chapter continues with a discussion of the contributions with respect to each of the three theoretical lenses. It also includes a discussion of how the results of this research contribute to the applied theories. The chapter concludes with a discussion of the methodological contribution.

I discuss the results of this project as a set of aspects that should be considered when fostering student engagement in online collaborative learning environments and providing them with effective scaffolding. The contributions of this thesis should not be treated as universal or deterministic. The set of aspects discussed incorporates contextually bound recommendations, focusing on presenting suggestions rather than prescriptions.

6.1 Practical Implications

6.1.1 Behavioral Engagement

Behavioral engagement implies students' actual participation and involvement in the learning activities (Fredricks et al., 2004). To engage in collaborative learning activities, participants need to have an online platform that provides them with the necessary functionality to do so. However, where multiple affordances are provided, it is important to ask which of these are picked up and appropriated by students as meaningful for the activity (Lund & Rasmussen, 2008).

In line with previous research, the results of this project indicate that learners need the tutor's guidance on the use of the tools to be able to effectively utilize them in the learning process (Lazareva, 2015a; Lazareva, 2017b; Lazareva, 2017c; Razon, Turner, Johnson, Arsal, & Tenenbaum, 2012). For example, the observations of student interactions in an LMS (Lazareva, 2015b) suggest that students may switch to alternative tools because of their lack of knowledge regarding the functionality of the technology used to run the online course.

The empirical findings obtained using observations (Lazareva, 2015b), a student survey and interviews (Lazareva, 2017a), and an experiment (Lazareva, under review) demonstrate that the asynchronous nature of collaborative learning discussions may have a significant impact on how these discussions are carried out. First, when taking part in asynchronous collaborative learning activities over longer periods of time, students tend to develop certain routines in organizing and managing their discussions (Lazareva, 2015b). The essential point here is to ensure that the routines that students adhere to are effective for collaborative learning. Several examples demonstrate that the asynchronous nature of communication often allows individual students to contribute to the discussion and then disappear, leaving his or her peers waiting (Lazareva, 2015b; Lazareva, 2017a; Lazareva, under review). This technically means that there is no need for students to be actively engaged all the time. Delayed feedback and long pauses in communication have generally been acknowledged as key drawbacks to the lack of synchronicity (Massey et al., 2003). This has negative implications for student behavioral engagement and the process of collaborative learning as it can impede sustaining joint attention on the issue at hand. Moreover, it can be difficult for peers to grab a missing person's attention on an asynchronous platform, and the missing person may end up never contributing to the joint

task (Lazareva, 2015b). Therefore, it is important that students establish group norms prior to the beginning of the collaborative learning process. One of the successful strategies observed during this project was a group contract agreement, which enabled students to agree on the aspects that they considered important for their collaboration, such as the frequency and quality of the contributions and the acceptable time range for posting a response (Lazareva, 2017a; Lazareva, 2017b).

By contrast, the results of the study that was carried out in a synchronous collaborative learning context (Lazareva, 2017c) demonstrate that having a tool for synchronous communication helped the peers stay focused on the issue at hand and allowed the collaborative attempt to remain ongoing. Thus, complementing an asynchronous online learning platform with synchronous communication tools may be an effective approach for tackling the challenges described above. While asynchronous interactions ensure flexibility and accessibility (Jeong & Hmelo-Silver, 2016), thus making it possible for students to participate anywhere and at any time, a synchronous tool provides learners with an opportunity to engage in a discussion in the here and now, which helps sustain a joint focus on the issue at hand.

However, it is not only the functionality of the tools that has a direct impact on student behavioral engagement. The findings of this project confirm that the psycho-social aspects of collaborative learning play a crucial role (Kreijns et al., 2003). For example, the interviews with African students taking part in the online collaborative learning course (Lazareva, 2017a) demonstrate that students may restrain themselves from posting their contributions on the group forum due to a concern that it will not be accepted by fellow students. This may lead to a decreased amount of contributions overall, and, consequently, the quality of the collaborative learning process may suffer. In this regard, the online tutor has been found to play a central role in creating and sustaining an open and respectful online collaborative learning environment as an aspect of social presence (Lazareva, 2017a). Moreover, in the focus group and individual interviews, the African participants reported that it was very important for the newcomers to receive guidance from the more knowledgeable and experienced peers when it came to the use of technology in the online course. The African participants often preferred to turn to their local peers for help and support despite the availability of the online tutor and course instructor in the online environment. This suggests that establishing a close community of

practice with supportive mentors and peers may be especially important in such contexts (Lazareva, 2018). Such communities of practice are normally emergent, establishing themselves in the process of the activity, which makes them different from groups and communities formed to solve a specific task (Brown & Duguid, 2000). Participants in such communities support each other by sharing problems, knowledge, and experience (Lave & Wenger, 1991).

Finally, the findings of this project also suggest that student behavioral engagement is supported by scripts. Scripted students produced more contributions overall (Lazareva, 2017c; Lazareva, under review). Scripting certain aspects of collaboration for students (e.g., following certain roles and sequencing and distributing task activities) helps to explicate a strategic approach and allows students to concentrate their efforts on the aspects emphasized in the script. This helps students avoid uncertainty regarding the proper way to approach the group task, prompting them to begin active participation.

Moreover, in line with the previous research, the results of this project suggest that “over-scripting” (i.e., cognitive overload created by a collaboration script) is likely to lead to students skipping parts of the script (Dillenbourg, 2002; Lazareva, 2017c). Therefore, for the collaboration script to have a positive impact on students’ behavioral engagement, its instructions should be formulated clearly and concisely.

6.1.2 Emotional Engagement

Emotional engagement is a psycho-social aspect of student engagement and refers to the way a student perceives teachers, peers, and academic work in general (Fredricks et al., 2004). Motivational aspects have been found to have an impact on students’ participation in online discussions (Martens, Gulikers, & Bastiaens, 2004). It has been acknowledged that this should not be taken for granted, as overlooking the psychological aspects of learning may have important implications for students’ overall level of engagement and willingness to put effort into their learning (Krejins et al., 2003).

The theoretical lens that has been found particularly suitable for understanding issues of student motivation in an online learning environment is the concept of social presence. In this project, the data were collected in different contexts, which has produced several implications for issues of social presence. The observations carried out at the beginning of the project focused on a student group working online (Lazareva, 2015b). However, these students had the opportunity to get to know each other during a two-week face-to-face

session at the beginning of the study program. The experiment carried out with the students working synchronously in Google Docs (Lazareva, 2017c) involved student groups where students were regularly attending face-to-face classes and were thus familiar with each other to some degree. The rest of the empirical work (Lazareva, 2017a; Lazareva, 2017b; Lazareva, under review) was carried out with students and student groups that included both participants who were familiar with each other and participants who had never met in real life and were thus unaware of each other's way of being. The latter instance (students who are unfamiliar with each other) is central to this research project when it comes to discussing aspects of social presence. In addition, all the data collection involved multicultural settings, with the exception of the synchronous collaborative writing assignment where the participants shared the same cultural context.

As introduced in Chapter 2, the feeling of social presence is highly dependent on the affordances of the communication medium (Gunawardena, 1995; Sung & Mayer, 2012). Thus, both the affordances perspective and the concept of social presence are important for understanding issues of student emotional engagement in the context of this research project. For example, earlier research findings demonstrate that text-based learning environments are least effective in supporting the development of engagement and presence in comparison with the virtual world condition (Franceschi, Lee, Zankakis, & Hinds, 2009). It is obvious that a lack of synchronicity has implications for social presence. It is true that asynchronous communication provides students with the opportunity to contribute to the discussion when they feel most comfortable and without being interrupted or judged (Popov, Noroozi, et al., 2014; Serçe et al., 2011). However, one of its key drawbacks, as described in the literature, is a lack of visual cues (Munkvold et al., 2011), which can often result in feelings of insecurity or misunderstandings among the collaborating participants.

The findings of this project also suggest that students often feel that their text is being misinterpreted by their peers in an asynchronous collaborative learning context (Lazareva, 2017a). Moreover, some of the interviewed students stated that they chose to switch to alternative media for communication as they felt insecure posting their contribution before they had "validated" it with their peers (Lazareva, 2017a). The focus group and individual interviews with the students suggest that differences in the cultural background of the participants may be one of the reasons for such behavior.

Students using an asynchronous learning platform often perceive this setting as impersonal, offering little opportunity to get to know their peers, online tutors, and course instructors (Lazareva, 2017a). Yet, depending on the group and its participants, social interactions and bonding could also be observed in an asynchronous context (Lazareva, under review).

Interestingly, students taking the one-year collaborative learning course were found to have different perspectives regarding the issue of socializing in an online class, with some of the participants holding the opinion that socializing is not really needed for better learning (Lazareva, 2017a). Similarly, the results of the study with the students using Google Docs to accomplish a synchronous collaborative writing activity suggest that some of the students enjoyed *not* using voice or video communication, which they believed usually increased non-task related talk (Lazareva, 2017c). These findings suggest that students taking part in asynchronous collaborative learning could benefit from synchronous sessions at the introduction of the course and, potentially, checkpoint sessions throughout the course. However, the implementation of such opportunities in the course design should involve flexibility in terms of students' commitment rather than enforcement.

However, it is not only the features of the medium that help collaborating participants build social presence. This is also highly dependent on the role of the online tutor, as the participants should be able to feel comfortable and secure in the process of collaborative knowledge building, sharing their opinions in a mutually respectful environment (Sung & Mayer, 2012). In this project, the role of the online tutor in establishing and maintaining the feeling of social presence in an online collaborative learning environment was explored. The findings build on earlier (rather scarce) research on the social role of the online tutor and contribute to the field by suggesting a range of practical guidelines for online tutoring. The findings demonstrate that the role of the online tutor was perceived by the students as significant when it came to the establishment of an open, trustful, and mutually respectful learning environment (Lazareva, 2017a). The formulated guidelines for online tutors suggest that it is important for the online tutor to bring the group's attention to individuals that are ignored by the rest of the group (Lazareva, 2017a). Moreover, the online tutor should promote awareness in student groups (Lazareva, 2015b; Lazareva, 2017a) regarding the subject-matter knowledge of the various group members

(Schreiber & Engelmann, 2010) and the students' current stage in the process of the collaborative task. The online tutor was also found to be a significant resource for helping students agree on shared values (Lazareva, 2017a).

6.1.3 Cognitive Engagement

Cognitive engagement refers to the degree of investment, willingness, and effort put into learning (Fredricks et al., 2004). In the context of collaborative knowledge construction, it is necessary for students to interact transactively, that is, build on each other's contributions. Without doubt, the features of the system used for collaboration have an impact on students' cognitive engagement. Thus, one of the main benefits of asynchronous learning discussed in the literature is that it provides more time for students to reflect (Popov, Noroozi, et al., 2014; Serçe et al., 2011). However, in this research project, I have identified some of the key challenges for effective collaborative learning that stem from a lack of synchronicity in the learning environment.

I have already discussed (see Section 6.1.2) how the asynchronous mode of interaction tends to have a negative impact on student behavioral engagement. Moreover, the findings of this project suggest that the asynchronous nature of communication also tends to result in more scattered student contributions (also termed "externalization"; see Weinberger & Fischer, 2006), thus impeding the overall transactivity of student discussions (Lazareva, 2017a; Lazareva, under review). While students with experience of collaborative learning and skills in self-regulation were found capable of tackling this issue (Lazareva, under review), students with less experience and fewer self-regulatory skills were likely to experience challenges and not fully utilize the potential of collaborative learning. In addition, the asynchronous mode of interaction was found to allow behaviors such as social loafing and lurking, with, for example, students posting short messages of agreement or encouragement without contributing to the discussion through new knowledge or critical insights (Lazareva, under review).

While the empirical findings obtained in the experiment on Google Docs clearly demonstrate that having a tool for synchronous communication helped the peers stay focused on the issue at hand, the results of this study also demonstrate that having a synchronous platform for collaborative discussions is not the only precondition for reaching higher levels of transactivity (Lazareva, 2017c). Although the students managed to keep their joint attention, they often settled for quick consensus building (Weinberger

& Fischer, 2006) when solving a task. These findings support recent empirical research suggesting that higher levels of temporal synchronicity do not automatically imply more transactivity in students' interactions (Popov et al., 2017). These findings suggest that additional means of external support should be provided to the students to enhance their engagement from the cognitive point of view, increasing the transactivity of their interactions. In this research project, the role of collaboration scripts in addressing the transactivity of student interactions has been investigated.

The transactivity of student interactions has been claimed to be the key aspect that needs to be addressed when facilitating learning through collaboration scripts (Vogel, Wecker, et al., 2016). In this research project, the unscripted students were often observed to keep their interactions at a lower degree of transactivity (Lazareva, 2017a; Lazareva, 2017c; Lazareva, under review). Another aspect that was clearly observed as the project progressed is that roles have a significant meaning in collaborative knowledge construction. For example, observations made at the beginning of the project confirmed earlier findings that the summarizer tends to be the most active role (Lazareva, 2015b), as the summarizer must be actively involved in following the discussions from the beginning to the end in order to be able to compile a meaningful outcome. In addition, the students reported that having an assigned leader in the group would have helped steer the synchronous collaborative writing activity (Lazareva, 2017c).

Thus, the final study of the project (Lazareva, under review) proved to be a good demonstration of how role assignments can be effective in prompting transactive interactions among learners. Having taken on a specific role, the student is able to understand the essence of this role and its meaning in the context of collaboration. For example, by being required to question his or her peers' contributions, the students develop critical thinking skills and are prompted to look for the most viable solution.

The empirical work on collaboration scripting carried out in this project resulted in several practical implications in terms of script design and implementation. Earlier research has argued that collaboration scripts should be designed to address a specific learning situation (Vogel, Wecker, et al., 2016). The findings obtained in this research project support the view that any collaboration script should be designed to facilitate certain aspects of the collaborative knowledge co-construction. Depending on the intended learning outcome, a collaboration script designed to help students develop

argumentation skills (Lazareva, under review) will be different from a script designed to help students employ effective coordination strategies (Lazareva, 2017c) as different script components will be in focus.

For example, during this research project, it became clear that unscripted students tend to leave the task of revising the final deliverable to one selected student in the group (the moderator, the summarizer, or simply a volunteer from the group), thus failing to address the revision of the final document as a joint effort (Lazareva, 2017c; Lazareva, under review). However, when scripted, the students followed the suggested procedure, and the joint revision of the deliverable turned out to be successful (Lazareva, 2017c). This suggests that a script to facilitate students' revision of the final deliverable should be developed, which could be applied in various contexts to help students handle this specific type of task.

One of the challenges identified in earlier research on collaboration scripting is that facilitating both domain-specific and domain-general knowledge through collaboration scripts may be ineffective (Kollar et al., 2007). In this research project, it is suggested that a combination of collaboration scripting and online tutoring is an optimal way to facilitate both types of knowledge (Lazareva, 2017b).

The role of the online tutor is fundamental in addressing domain-specific aspects during the process of collaborative knowledge construction. The online tutor can provide relevant discussion pointers and learning materials that scaffold knowledge building in the group, and the students observed at the beginning of the research project eagerly followed the hints provided by the online tutor (Lazareva, 2015b). The survey and interviews carried out with the students taking the one-year online collaborative learning course revealed that students consider it highly important for the online tutor to provide domain-specific input on their discussions (Lazareva, 2017a; Lazareva, 2017b).

However, it remains a challenging issue for the online tutor to identify how much domain-specific support is necessary when it comes to certain groups or even individual students. The results suggest that some groups are more independent and that too much tutor intervention may impede the collaborative learning process (Lazareva, 2017a). It may be beneficial to complement asynchronous collaborative learning with synchronous sessions with an online tutor so that he or she can ensure an appropriate level of domain-specific scaffolding.

Finally, the findings of this research project suggest that the role of the online tutor is central to the process of implementing the script, monitoring its effects, and phasing out or terminating its use (Lazareva, under review).

6.1.4 Overview of Practical Implications

Table 9 provides an overview of the practical implications for CSCL discussed in Section 6.1.

Table 9. Overview of practical implications for CSCL

Antecedents of engagement	Practical guidelines
Student behavioral engagement	
Knowledge of the learning platform	— Students need explicit and sufficient guidance on the functionality of the learning platform.
Increased level of participation	<ul style="list-style-type: none"> — Establish group norms. — Complement the asynchronous platform with synchronous communication channels. — The online tutor should emphasize the equal importance of contributions by each of the group participants.
Strategic approach to task	<ul style="list-style-type: none"> — The collaboration script should explicate a strategy enabling students to concentrate their efforts, which reduces their uncertainty in terms of the proper way to address the task and prompts more active participation. — The script instructions should be clear, concise, and sufficiently detailed.
Student emotional engagement	
Getting to know each other and providing opportunities for social interaction	<ul style="list-style-type: none"> — The asynchronous learning environment should be complemented with a synchronous introductory meeting and regular checkpoint meetings to consider progress. — Students should be provided with the opportunity for social interactions, but this should not be enforced.
Inclusive and open learning environment	<ul style="list-style-type: none"> — The online tutor should draw students' attention to the contributions that were not commented on. — The online tutor should support the members in establishing shared values in the group. — The online tutor should promote awareness in the group.

Table 9. Overview of practical implications for CSCL (continued)

Antecedents of engagement	Practical guidelines
Cognitive engagement	
Transactivity of student interactions	<ul style="list-style-type: none"> — Unexperienced students need additional support irrespective of whether or not the environment is asynchronous. — Assigning roles (e.g., proposer, critic, and summarizer) is effective for improving the transactivity of student discussions.
Script design and implementation	<ul style="list-style-type: none"> — Collaboration scripts must be designed to facilitate certain aspects of the collaborative knowledge co-construction. — The collaboration script should be introduced by the tutor, who will also monitor its effects and adjust the instruction if necessary. The tutor should also monitor that the strategies promoted by the script are internalized by the students after the script itself has been terminated.
Facilitation of domain-specific and domain-general knowledge	<ul style="list-style-type: none"> — When facilitating domain-general knowledge acquisition through collaboration scripts, the online tutor should provide domain-specific scaffolds for the collaborating students. — The online tutor should organize synchronous progress checkpoints to increase teaching presence and domain-specific scaffolding.

6.2 Theoretical Contributions

This section discusses the contributions of the three theoretical lenses to the main research question of how to support student engagement in online collaborative learning environments. The theories that have been applied in the research project are the theory of affordances, social presence, and the script theory of guidance. These play a complementary role in explaining the aspects of student engagement. Thus, the theories of affordances and social presence have been seen to be effective in addressing behavioral, emotional, and cognitive engagement, while the script theory of guidance was relevant to issues of behavioral and cognitive engagement. In section 6.2.5, I discuss how this research project can contribute to the further development of these perspectives.

6.2.1 Affordances

Earlier CSCL research has been carried out in the context of various technological tools. This includes, for example, social media (Lampe, Wohn, Vitak, Ellison, & Wash, 2011; Vasiliou, Ioannou, & Zaphiris, 2014), wikis (Hadjerrouit, 2014; Palomo-Duarte et al., 2014; Wheeler, Yeomans, & Wheeler, 2008), learning management systems (LMS; Ku, Tseng, & Akarasriworn, 2013; Nam, 2014; Schoor & Bannert, 2012; Tobarra, Robles-Gómez, Ros, Hernández, & Caminero, 2014), concept mapping software (Engelmann & Hesse, 2011; Schreiber & Engelmann, 2010), and authoring tools (Dehler, Bodemer, Buder, & Hesse, 2011; Fransen, Kirschner, & Erkens, 2011; Noroozi, Biemans, Busstra, Mulder, & Chizari, 2011; Sangin, Molinari, Nüssli, & Dillenbourg, 2011). Another aspect of CSCL research has focused more specifically on the affordances of the technologies employed for CSCL (Bower, 2008; Jeong & Hmelo-Silver, 2016; Suthers, 2006). In this project, instead of focusing on a specific kind of technological tool, I have chosen to apply the concept of affordances as a theoretical lens to understand the connection between the features of the learning environment and students' collaborative interactions.

Most of the empirical data collection was carried out in the context of an LMS that only supports asynchronous interactions among learners. Even though it may be argued that this type of LMS is a dated technology, much learning is still taking place in similar contexts, with students interacting in asynchronous learning environments. Therefore, it is important to gain a better understanding of the implications that a lack of synchronicity may bring. As a result, the issue of synchronicity became a key point of discussion in this dissertation. One of the advantages of selecting the affordances lens is that focusing on affordances instead of specific tools makes the results relevant across different technological contexts. I have chosen to adopt the classification of Van Osch and Mendelson (2011), who distinguish between designed, improvised, and emergent affordances to discuss how a lack of synchronicity may affect collaborative interactions among students.

The asynchronous forums on the LMS were demonstrated to have a significant impact on students' development of strategies for approaching online collaborative learning. The discussion forums on the LMS provided learners with a designed affordance for communication as all the participants could post their contributions at any time. This affordance was perceived and actualized by the participants, making it possible for

students with different schedules and commitments (and located in different time zones) to work together on shared assignments, thus having a positive impact on their behavioral engagement. Moreover, this affordance also provided the students with the opportunity to reflect before posting their contributions, which can be considered as generally positive for their cognitive engagement. However, long pauses in communication and the extended time allowed for reflection often resulted in lengthy contributions that reflected individual learning but not *collaborative* meaning making, which is negative for overall student cognitive engagement as it reduces the level of transactivity. This can be explained by the fact that the affordances for co-construction and collaborative learning were mainly provided through the threaded discussions format (with the possibility of answering a specific message posted previously). Functionality such as pre-organized input areas and message starters were not specifically designed for the LMS. Moreover, this mode of interaction allowed students to develop lurking strategies as it was possible to post a brief comment and then leave the platform. However, some participants were observed to actively improvise an affordance for transactive interactions by building on each other's contributions during their discussions on the LMS forums. The LMS platform also allowed the participants to restrain themselves from contributing (e.g., due to fear of their contribution being rejected by their peers). This is an example of an emergent affordance that may have a negative impact on student behavioral and emotional engagement.

The LMS platform also provided students with the opportunity to use a built-in collaborative text editor (a designed affordance). However, it was demonstrated that students sometimes preferred to switch to alternative tools for collaborative text editing, which can be explained by their lack of knowledge of the functionality of the LMS. Their failure to perceive the designed affordances of the system tended to result in decreased levels of interaction within the system overall.

The LMS did not provide the participants with affordances for social communication (e.g., advanced individual profile pages were not available in the system). Thus, the degree of social interaction on the platform normally remained limited (which may or may not have implications for student emotional engagement). However, in some groups, students were observed to engage in off-task social interaction in the group discussion forums created for learning assignments, thus improvising this affordance.

The results of the study carried out in a synchronous collaborative learning context demonstrate that a synchronous chat tool provides learners with a designed affordance for sustaining joint attention on the issue at hand. This affordance was actualized by the students. Moreover, the co-writing affordance was much appreciated by the students, and the ability to engage in real-time synchronized collaborative writing was commented on positively. The only problematic aspect reported was the challenge of following the changes made by several people simultaneously. However, even though students may have the opportunity to engage in a synchronous discussion and maintain their joint attention on the issue at hand, this does not necessarily imply that their discussion will be transactive. While both asynchronous and synchronous collaborative learning platforms provide opportunities for students to engage in transactive discussions, the results of this research indicate that most students usually do not actualize this affordance unless they are explicitly prompted to do so.

The affordances perspective turned out to be an appropriate lens for understanding the potential impacts of the technology on collaborative learning processes, acknowledging the students' different approaches to and interpretations of the same tool.

6.2.2 Social Presence

One of the advantages of the theoretical perspective of social presence as part of the frame of this research project is that it provides an opportunity to address the psycho-social issues of collaborative learning. Another advantage lies in the fact that this theoretical lens acknowledges the importance of both technological tools and human participants in the process of establishing and maintaining an open and comfortable learning environment.

As discussed in Section 6.1.2, asynchronous text-based technological tools are generally not effective in promoting the feeling of social presence among the collaborating participants. Thus, the findings of this research confirm earlier work in the field, providing empirical examples to demonstrate how such technology may negatively affect the psycho-social aspect of the learning environment and, consequently, the flow of student interactions.

The students reported that they felt their text contributions were sometimes misinterpreted by their peers. Moreover, some students switched to alternative communication media as

they wanted to quality-check their ideas and opinions with their peers in an informal environment before posting them on the course LMS. Thus, these affordances of the learning environment may have implications for student behavioral and emotional engagement.

Moreover, the LMS was in general perceived by the students as impersonal, providing little opportunity for social interactions. Interestingly, this does not necessarily have implications for student emotional engagement, as one of the unexpected findings was that not all the students viewed this as a disadvantage. Some students stated that increased levels of social interaction were not necessary for learning. This challenges the social presence perspective on the importance of personal interactions in the context of collaborative learning processes.

The findings of this research suggest that the online tutor's involvement in asynchronous collaborative learning environments is vital for establishing and promoting a feeling of social presence among the participants. In particular, the online tutor should ensure an open, respectful, and encouraging atmosphere. This has an impact on student emotional engagement as, according to the theory of social presence, it is essential that students taking part in online collaborative learning processes should feel encouraged and see that their contributions are acknowledged by other participants in the learning situation. From the point of view of cognitive engagement, feeling secure in the learning environment allows students to share their opinions freely, raising critical questions without fearing that they might be viewed unfavorably. This is a crucial aspect from the point of view of a successful collaborative learning process.

6.2.3 Script Theory of Guidance

As pointed out earlier (see Section 6.1.3), the findings of this work support the view that collaboration scripts should be aimed at targeting specific goals and designed for specific learning situations (Raes et al., 2016; Vogel, Wecker, 2016). Existing research and knowledge on collaboration scripting provided the background for targeting specific aspects of student collaboration in this project (e.g., the sequencing of learning activities and role distribution). This made it possible to assess the process of collaborative learning systematically, thus drawing implications for theory and practice.

Employing the collaboration scripting lens is also beneficial because collaboration scripts can be introduced as an extended instruction, thereby not requiring specific functionality from the technological tool being employed. This makes the current discussion relevant across various technological platforms.

The collaboration scripts developed and implemented in this project were designed to prompt students to actualize certain affordances of the environment. Thus, the collaboration scripts elaborated a strategy for the students to follow, which made the students produce more contributions overall when compared to the unscripted groups. This makes it possible to conclude that providing students with a collaboration script has a positive impact on student behavioral engagement. However, in cases where the script instruction led to extra cognitive load for the students, the collaboration scripts failed to have an impact on behavioral and cognitive engagement as the students tended to skip (parts of) the script.

This research project has identified that findings from CE should be utilized by CSCL researchers to learn more about how to avoid increasing students' cognitive load as a result of heavy scripting (Lazareva & Munkvold, 2017). The CE documentation is designed specifically for distinct types of tasks to be handled in teams. Moreover, it is kept concise to decrease the information overload and address key processes effectively. It could thus be beneficial for CSCL research to study the principles of CE documentation and the formulation of guidelines targeted at specific collaborative activities.

The collaboration scripts in this project were to a substantial extent aimed at increasing the transactivity of student interactions, thus targeting student cognitive engagement in learning. As a result, the role concept clearly emerged as an effective approach for increasing the transactivity of student interactions.

Finally, much of the discussion focused around the role of the online tutor in relation to collaboration scripts. It is suggested in this project that while collaboration scripts are an effective means for developing students' general collaboration skills, the role of the online tutor is crucial in ensuring domain-specific scaffolding for students. The role of the online tutor is also important in the script implementation phase. The online tutor can ensure that the script is being followed by the students and adjust the script instructions in cases where the script is proving ineffective due to students' varying levels of

collaboration skills. The results of the project also suggest that the role of the online tutor may be vital in monitoring the effects of the script on students' general collaboration skills after the script has been terminated.

6.2.4 Overview of Theoretical Contributions

Table 10 provides an overview of the theoretical contributions to the field of CSCL.

Table 10. Theoretical contributions

Lens	Contributions
Affordances	<p><i>Helped explain issues of student behavioral, emotional, and cognitive engagement</i></p> <ul style="list-style-type: none"> — Failure to perceive the designed affordances tends to result in decreased levels of interaction within the system. — The asynchronous format of collaborative learning has an impact on students' development of learning strategies (with designed affordances for flexible and reflective communication but only limited designed affordances for transactive interactions and a lack of affordances for social interactions). — Some students compensate for limited or missing affordances in the asynchronous learning environment (e.g., some students improvised affordances for transactive interactions and off-task social interactions). — Synchronicity helps students maintain joint attention but does not automatically imply transactivity in the discussion. — Students should be prompted to actualize the affordances for transactive interactions irrespective of whether or not the technological platform allows for synchronous communication.
Social presence	<p><i>Helped explain issues of student behavioral, emotional, and cognitive engagement</i></p> <ul style="list-style-type: none"> — Communicating by text can often make students feel their text is being misinterpreted. — Informal learning spaces are important for some students to quality-check their ideas. — Asynchronous learning environments do not usually allow much space for social interaction and getting to know one another, and they are perceived by students as impersonal. — The relevance of social interaction is viewed differently by individual students. — The online tutor plays a key role in establishing an open, trustful, and mutually respectful learning environment.

Table 10. Theoretical contributions (continued)

Lens	Contributions
Script theory of guidance	<p><i>Helped explain issues of student behavioral and cognitive engagement</i></p> <ul style="list-style-type: none"> — Depending on its complexity, the collaboration script may have either positive or negative effects on student behavioral engagement. — Research on CE can inform CSCL in terms of designing scripts that can reduce students' cognitive load and address specific learning activities. — The role script component is key to the increased transactivity of student interactions. — The combination of collaboration scripting and online tutoring is an optimal way to facilitate both domain-specific and domain-general knowledge acquisition.

6.2.5 Contributions to the Applied Theoretical Lenses

In this section, I will discuss how this research contributes to the chosen theoretical perspectives.

It is important to discuss the combination of the chosen theoretical perspectives for understanding and explaining the multidimensional concept of student engagement in online collaborative learning environments. Much of the research effort in the field of CSCL focuses on affordances, good practices for online facilitation, and principles for the effective design and implementation of collaboration scripts. However, a discussion of the combination of these aspects is lacking. As discussed in Section 2.6, the combined application of the chosen theoretical perspectives in this project allows for a comprehensive understanding of student engagement. Moreover, their possible cross-fertilization contributes to further development and refinement of the lenses. For example, employing the social presence perspective is helpful in identifying underdeveloped/dysfunctional group processes that may impede the successful appropriation of a collaboration script. As an example, a critic's contributions on the forum being ignored or considered irrelevant may decrease the quality of his or her role performance and overall commitment. In this case, it is important for the online tutor to bring the group's attention to the contributions that are not taken up. Similarly, implementing collaboration scripts aimed to support certain types of tasks may help us identify what affordances the system is lacking to allow for an effective collaborative learning process. This way, it is ensured that all three types of student engagement are addressed.

In addition, the combination of these theories has made it possible to design and carry out a CSCL-focused research project within the framing of an IS PhD program, thus demonstrating that these two fields share several focal areas of interest. This project focused on the discussion of effective online group facilitation practices which is topical in both CSCL and IS research, thus contributing to bridge the gap between these two domains. One of the contributions of this project is the identified potential synergies between CE and collaboration scripting.

While the combination of these theoretical lenses has proven to be a solid approach for understanding student engagement in online collaborative learning environments, I believe that it is also important to discuss how differences in the cultural background of the participants may have influenced the practices observed in this research project. Even though this project did not have the cultural component as a primary focus of investigation, I found that this was a significant issue to be considered when interpreting the findings. Indeed, it is acknowledged that culturally diverse groups consider different behaviors to be critical for the completion of common tasks (Dekker, Rutte, Van den Berg, 2008) and have different perceptions of CSCL (Popov, Noroozi et al., 2014). Among the difficulties found in multicultural groups are decentralized thinking, misunderstandings, and a general lack of agreement on the course of action. Reduced social presence may further complicate understanding among collaborating peers (Popov, Noroozi, et al., 2014). Heterogeneous groups usually have more varied opinions (Lim & Liu, 2006). Recently, there has been some research on collaboration scripting in cross-cultural groups; however, in general, such research is scarce (Popov, Biemans, et al., 2014) and much remains to be learned. It is also a challenge to define the variable of culture, as it cannot be viewed as absolute or static (Avison & Myers, 1995; Ess & Sudweeks, 2006; Leidner, 2010; Walsham, 2002). Nationality-based features of culture may offer only a restricted view (Hewling, 2006), as it has become more and more typical for hybrid identities to emerge from intercultural flows (Ess & Sudweeks, 2006). Based on this research project I argue that complementing the chosen theoretical perspectives with a more culture-oriented lens would allow for a richer analysis of the findings.

6.3 Methodological Contributions

The studies on collaboration scripting carried out during this project (Lazareva, 2017c; Lazareva, under review) also provide a methodological contribution. The main method of

data analysis used in the studies on collaboration scripting was qualitative content analysis. In both studies, a previously developed and used coding scheme was modified to be able to describe the collaborative learning process in a more precise manner. The framework developed by Curtis and Lawson (2001) was adapted to be suitable for analyzing synchronous interactions. Two categories were added (“monitoring presence” and “emotion expression”), which reflected the character of certain interactions that were observed relatively frequently in all the groups but did not fit any of the categories in the original framework. The other framework used for the qualitative content analysis was that of Gunawardena et al. (1997). This framework was later employed by Hull and Saxon (2009), who further elaborated the categories. The final experimental study in this project builds on both versions. However, the framework was adjusted to cover all the utterances produced by the participants. For example, Phase I—“coordination moves”—was added as this type of interaction was frequently observed in the groups. The two coding schemes, which document the categories and their meaning in closer detail, can be found in Appendices 7 and 8 of this thesis. It is hoped that these coding frameworks will be useful for future research on CSCL and collaborative knowledge construction.

7 Conclusions

This chapter presents the answers to the research questions introduced in Chapter 1. This is followed by a discussion of the limitations of this research project and suggestions for key directions for future research. The main theoretical and practical implications have been presented in Chapter 6 and summarized in Tables 9 and 10.

7.1 Answering the Research Questions

The main RQ is formulated as follows: *How can students' behavioral, emotional, and cognitive engagement be supported in the context of computer-supported collaborative learning (CSCL)?*

This is divided into three SQ:

- SQ1: How does the asynchronous mode of interaction affect the process of online collaborative learning in the context of a university course?
- SQ2: How can the online tutor contribute to building an inclusive online learning environment and promoting effective collaborative interactions among students in the context of a university course?
- SQ3: How can collaboration scripts promote effective online collaborative interactions among students in the context of a university course?

As elaborated in Chapter 1, the individual articles in this thesis address one or more of the questions above. By combining the results of all the papers, it becomes possible to answer the research questions together. The following sections first address each of the sub-questions, and then the discussion of the main research question is presented.

SQ1: How does the asynchronous mode of interaction affect the process of online collaborative learning in the context of a university course? Generally, the asynchronous character of the learning platform made the students perceive the environment as impersonal. While some of the students believed that social interactions on the course platform were unnecessary for their learning, others actively maintained off-task social aspects of group communication in the asynchronous course platform. Moreover, asynchronous text-based communication often made students feel that their text was misinterpreted by their peers. These findings suggest that online students should be provided with better opportunities for social interaction with each other, and

complementing the asynchronous platform with synchronous communication channels is a possible solution.

The asynchronous mode of interaction was also found to have implications for the development of student learning strategies. Given the opportunity to reflect and the flexibility to participate, some students were found to maintain transactive interactions in the asynchronous platform. However, some students demonstrated a habit of posting lengthy contributions that were not related to earlier inputs by their peers. Moreover, some students used the opportunity to engage in lurking or social loafing strategies. Employing a synchronous platform for collaboration helped students to effectively keep their joint attention on the issue at hand, although they did not necessarily reach higher levels of transactivity. This suggests that students should be provided with external support in the form of a collaboration script irrespective of whether or not the learning platform is synchronous.

SQ2: How can the online tutor contribute to building an inclusive online learning environment and promoting effective collaborative interactions among students in the context of a university course? To promote the feeling of social presence in the online learning environment, the online tutor should promote awareness in the group, help the group agree on shared values, underline the equality of individual contributions in terms of their importance, and bring attention to individual contributions that have been ignored by the group. This is important for students' behavioral and emotional engagement. Moreover, an open and inclusive environment in which students feel free to share opinions and be critical is a vital precondition for reaching cognitive engagement.

The online tutor also supports students' domain-specific cognitive activities by prompting them with hints and guiding questions. However, it may be a challenge for the tutor to identify the appropriate degree of scaffolding for specific groups. Engaging students in synchronous checkpoint meetings may help the online tutor to evaluate students' current progress and adjust the degree of scaffolding.

SQ3: How can collaboration scripts promote effective online collaborative interactions among students in the context of a university course? Overall, the scripted students were found to be more active than the students in the unscripted condition. However, providing too much detail through collaboration scripts can result in information overload, making students skip parts of the script. Thus, collaboration scripts

should be formulated clearly and concisely and aim at supporting specific learning activities. For example, scripting student roles (e.g., proposer, critic, and summarizer) in the group proved an effective way of promoting the transactivity of student online discussions.

This research also suggests that it is optimal to combine the collaboration scripting approach with online tutoring. While collaboration scripts should mainly target students' general collaboration skills, the online tutor's input should target students' domain-specific knowledge. Moreover, the role of the online tutor is important in the process of script implementation.

RQ: How can students' behavioral, emotional, and cognitive engagement be supported in the context of computer-supported collaborative learning (CSCL)?

Asynchronous and synchronous forms of interaction should be combined to ensure flexibility for students, provide time for reflection and analysis, introduce better opportunities for off-task personal interactions, and prevent students from developing ineffective collaborative learning strategies.

Students' domain-general collaboration skills should be facilitated by collaboration scripts, combined with online tutor support focused on facilitating students' domain-specific knowledge acquisition through prompts, hints, and critical questioning. The role of the online tutor is crucial for introducing collaboration scripts, monitoring their effects, and adjusting, phasing out, or terminating them. In addition to facilitating domain-specific knowledge acquisition, support from the online tutor helps establish a feeling of social presence in the online learning environment.

Figure 3 illustrates how the combined support of online tutoring and collaboration scripts provides the main answer to the research question.

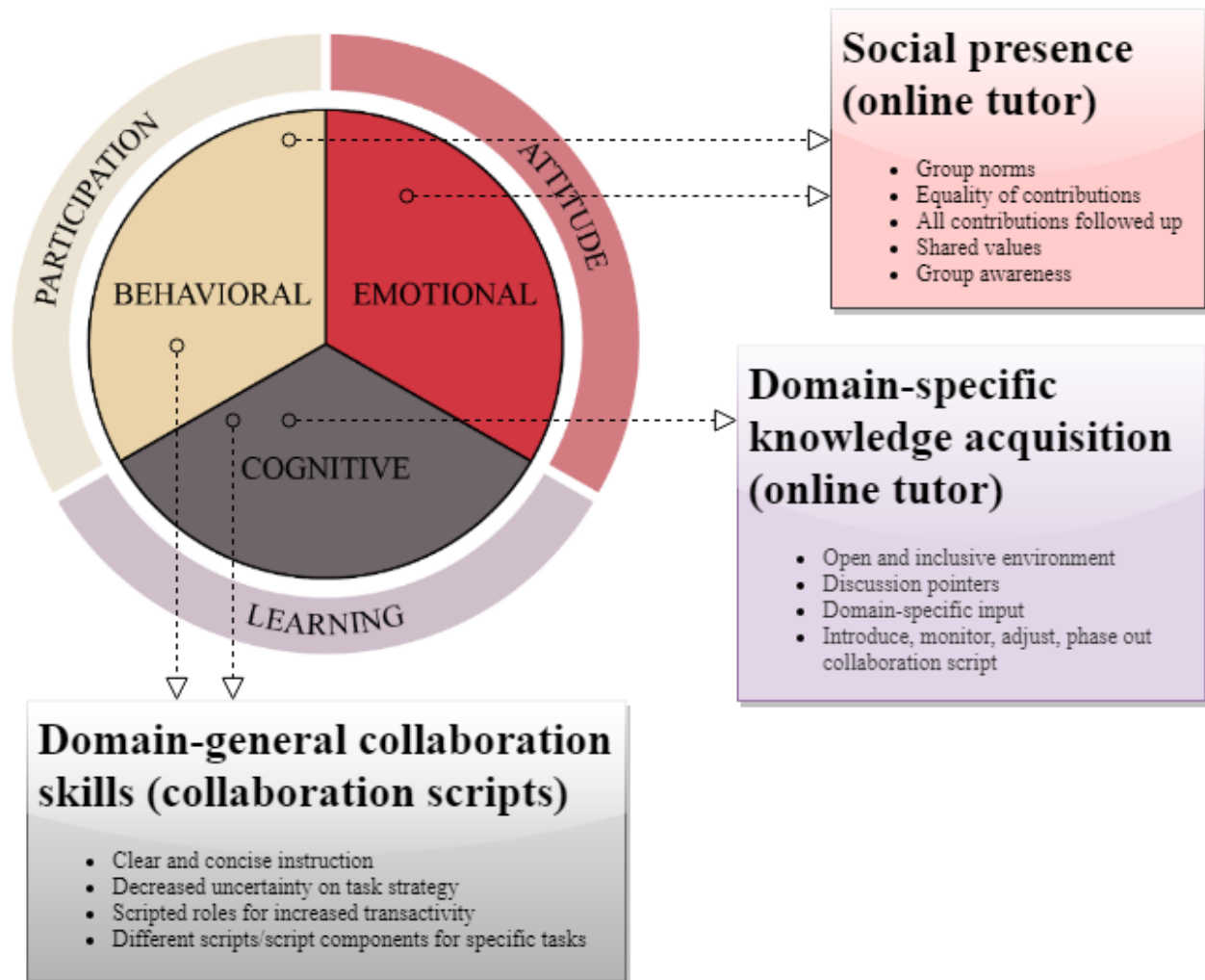


Figure 3. Combining collaboration scripts and online tutoring to support student engagement.

7.2 Limitations

This section discusses the possible limitations of this research study.

Measuring learning. It could be argued that the learning outcome is the most important aspect to be analyzed and that evaluating the learning process is an invalid way of measuring learning. However, in collaborative learning, interactions among the participants constitute a key component of learning, and the quality of interactions has a direct impact on the learning outcomes. General collaboration skills need to be learned and practiced. Therefore, much of this research focuses on the quality of student interactions in addition to their learning outcomes. Qualitative approaches were employed in this project to analyze the data. The attempt was made to focus on intersubjective meaning making rather than measuring individual students' learning (e.g., through pre-

and post-tests). Student collaboration was analyzed by means of content analysis, which has helped describe and characterize the process. In addition to using descriptive statistics, the processes developed in each of the groups have been briefly presented to get a full picture (Lazareva, 2017c; Lazareva, under review).

Type of technology. The empirical data collection in this research project mainly focuses on the use of an asynchronous LMS platform, and this technology affected the student interactions in certain ways. One limitation is that more advanced technological platforms were not considered in this research. However, the affordances lens applied in the project has the advantage of focusing on the features of the tool rather than the tool itself, which makes the discussion relevant for other settings. In addition, much learning is still taking place on LMS platforms offering similar affordances. Therefore, it is important to understand how such technology can be used effectively.

Number of participants. The empirical data collection was carried out with a limited number of participants. While it is not possible to speak about the statistical generalization of the results, the results are generalizable in an analytical sense. Qualitative data analysis made it possible to focus in close detail on the learning processes occurring in the groups, uncovering issues that would not be accessible through quantitative techniques applied to a larger number of participants.

Short-term experimental design. In both experimental studies, the groups were supported by scripts during one learning assignment only. While this made it possible to compare the learning process in scripted and unscripted conditions, it was still not possible to see how (and whether) students would internalize the collaborative learning strategies promoted by the scripts. Recent research suggests that students must be supported by scripts repeatedly to internalize the effective strategies (Vogel, Wecker, et al., 2016), which is in line with the findings of this study. In addition, the varying duration of my studies in the asynchronous and synchronous settings is a limitation with respect to their comparison.

7.3 Future Research Directions

While contributing to the field, the results of this project also help to identify areas where further research is needed. These are briefly outlined below.

Theoretical perspectives. The digitalization of society increasingly invites cross-field theorizing and research. Thus, approaching the issues of creating an engaging CSCL environment from a different theoretical perspective could uncover aspects that have not been discussed before. For example, theoretical lenses such as adaptive structuration theory and media synchronicity theory could provide novel insights into how students adopt technological tools in the process of collaborative learning, including how the features of the tools affect the flow of students' interactions. Moreover, as discussed in one of the papers included in this thesis (Lazareva & Munkvold, 2017), the principles of CE could be employed to inform the research on collaboration scripting.

Collaboration scripting combined with online tutoring. Earlier CSCL research has focused on either the online tutor or the implementation of collaboration scripts. This research project has initiated an attempt to focus on both aspects in combination. More research is needed on the role of the online tutor in implementing scripts, monitoring their effects, and phasing out or terminating them.

The role of the students' cultural background. Due to the scope of this project, there was no specific focus on cultural aspects in this research. Nevertheless, the multicultural context of the data collection suggests that the cultural background of the participants may be an important factor for understanding and explaining how they engaged in the group collaborative learning process. Earlier research has acknowledged that different behaviors are considered important for successful task completion in different cultures (Popov, Noroozi, et al., 2014). This undoubtedly had an impact on the group dynamics of the participants in this research, and I have attempted to account for the occasions where this might have been the case. More research focusing on the role of the cultural background of CSCL participants is needed to bring the field forward.

Internal scripts. Identifying the level of initial internal scripts remains an issue in the research on collaboration scripting. Moreover, more effective approaches to the real-time analysis of student interactions are needed for online tutors to be able to address the issues arising during the process of collaborative knowledge construction and adjust the amount of scripting accordingly.

New learning platforms and social networking tools. Contemporary technology trends have a large impact on everyday interactions that should not be ignored. It needs to be

considered how existing and emerging technologies and their combinations can be used to support and enhance student learning (Douligeris & Seralidou, 2017). The findings of this project suggest that learning platforms need to be considered together with social networking tools as much of the student interaction took place on platforms that were different from the formal course environments. The role of informal communication arenas becomes especially important in the context of online learning where learners do not have the opportunity to meet face-to-face. Contemporary technology trends have important implications for the field of CSCL, as issues of social presence, available affordances, multiculturalism, and informal learning are becoming an integral part of CSCL practice.

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Appendix 1. Research on Online Collaborative Learning in Top IS Journals (2000-2015)

Authors	Journal	Setting	Main topics
Conceptual contributions			
Alavi & Leidner (2001)	ISR		Potential of TML as a research area in the field of IS
Sharda, Romano, Lucca, Weiser, Scheets, Chung, & Sleezer (2004)	JMIS		Potential of CSCL requiring immersive presence as a research area in the field of IS
Gupta & Bostrom (2009)	JAIS		Theoretical model of TML based on adaptive structuration theory
Schmeil, Eppler, & Freitas (2012)	JAIS		Avatar-based collaboration framework
Explorative studies			
Neville, Heavin, & Walsh (2005)	JIT	Semi-structured interviews with academics using the institutional LMS	LMS as an academic equivalent to customer relationship management; factors for effective LMS design; the role of the facilitator
Kawalek & Hart (2006)	JIT	Action-based project on e-learning involving trainers and educators	Methodological principles for monitoring and managing e-learning processes in divergent groups
Gasson & Waters (2013)	EJIS	Graduate online courses	Application of the grounded theory method to investigate learners' engagement with a community of peers in online courses
Experiment-based articles			
Alavi, Marakas, & Yoo (2002)	ISR	An executive development program (206 executives from a federal agency)	Two collaborative distance learning environments (GSS and non-GSS conditions) and their learning effectiveness

Kwok, Lee, Huynh & Pi (2002)	EJIS	12 four-member groups, second year IS undergraduates	Effects of GSS on externalization of the learners' contributions (GSS and non-GSS conditions)
Kwok, Ma, & Vogel (2002)	JMIS	24 four-member groups, undergraduate students in management IS	Effects of GSS and content facilitation on group processes, cooperation in learning, and individual knowledge structures (2X2 factorial design)
Gemino, Parker, & Kutzschan (2005)	JMIS	72 undergraduate students in management	Impact of context-relevant graphics on learning processes in a technology-mediated collaborative environment (three types of graphics in the visual chat room: blank room, context-irrelevant graphic room, and the context-relevant graphic room)
Franceschi, Lee, Zanakis, & Hinds (2009)	JMIS	72 (24 in each condition) undergraduate business students	Impact of three different learning environments (Blackboard, Second Life, and a traditional classroom) on students' sense of presence and performance on the task
Eryilmaz, Ryan, van der Pol, Kasemvilas, & Mary (2013)	JAIS	30 doctoral students, introductory research methods course	Impact of three different discourse systems on the quality and flow of students' online asynchronous discussions (traditional forum layout; the parallel artifact-centered discourse system, the linked artifact-centered discourse system ("anchored discussion"))
Gupta & Bostrom (2013)	ISR	701 students, introductory management IS course	Effectiveness of different training methods: technology-mediated (using vicarious and enactive learning), collaborative and combined (2X2 factorial design)

Papers included in the review:

Alavi, M., & Leidner, D. E. (2001). Research commentary: Technology-mediated learning – A call for greater depth and breadth of research. *Information Systems Research*, 12(1), 1–10.

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Sharda, R., Romano Jr., N. C., Lucca, J. A., Weiser, M., Scheets, G., Chung, J.-M., & Sleezer, M. (2004). Foundation for the study of computer-supported collaborative learning requiring immersive presence. *Journal of Management Information Systems*, 20(4), 31–63.

Appendix 2. Interview Guide for Program Coordinator

Guiding questions

Technological platform

- (1) What are the technological tools used in the program to deliver the learning materials and carry out collaborative learning activities in groups?
- (2) Do students get training on the use of the tools, when and what kind of training is it?
- (3) Have course instructors and tutors pointed out any aspects of the technological platform that are missing or not functioning well?
- (4) Have students pointed out any aspects of the technological platform that are missing or not functioning well?
- (5) Are students encouraged to use complementary technological tools and platforms for better collaboration?

Collaborative learning assignments

- (1) What kind of collaborative learning activities are typical for the program?
- (2) What kind of support do students get to carry out the collaborative learning activities successfully?
- (3) What are the strategies for maintaining student engagement in online collaborative learning activities?
- (4) How are students assessed in the group? How are students assessed individually?
- (5) What aspects of collaboration have been experienced by students as the most challenging?

Appendix 3. Focus Group Interview Guide

Introduction of the interviewer

- (1) Research interests: Some of the questions are based on the survey responses
- (2) Purpose, duration and form of the interview: Open discussion, participants are encouraged to be proactive
- (3) Recording procedures: Recording can be shut down temporarily if a participant wishes so

Section 1: Social presence in the online learning environment

- (1) Did you feel you got a chance to learn more about your peers, online tutor and course instructor in the beginning of the course?
- (2) Did you get to know your peers, online tutor and course instructor better throughout the course?
- (3) Have you used any other complementary tools when communicating with your peers, and what difference did it make in the way you communicated?
- (4) Have you felt encouraged to participate in the course discussions?
- (5) Would you like to have had more off-task interactions with your peers? Why, or why not?

Section 2: Supporting distributed multicultural groups

- (1) Have there been some differences in the way you and your Norwegian peers approached the learning tasks?
- (2) What do you think is the most rewarding in the multicultural setup?
- (3) What do you think is the most demanding in the multicultural setup?
- (4) Have there been some differences in how you interacted with each other and referred to each other's contributions?
- (5) Have there been any misunderstandings that you think could be related to the differences in cultural backgrounds?

Conclusion

- (1) Other issues: Learning management system, learning tasks, assessment, other
- (2) Thank the participants

Appendix 4. Interview Guide for Individual Interviews

Social presence

- (1) Were the text-based introductions in the beginning of the course useful?
- (2) Do you feel you got to know your Norwegian/African peers throughout the course?
- (3) Does knowing your peers better affect the way you interact in the course forum?
- (4) Can you think of any other activities that could be used for you to get to know your peers better?
- (5) Did you use any other platforms or tools to communicate with your peers?
- (6) What difference would it make if you could interact with your peers synchronously?
- (7) Was it easy for you to approach the online tutor and course instructor?
- (8) Have there been some misunderstandings that could be prevented by the online tutor or course instructor?

Cultural aspects

- (1) Did you and your Norwegian/African peers approach the learning tasks differently?
- (2) Was there any difference in how you and your Norwegian/African peers expressed themselves?
- (3) Did you find it difficult to work in multicultural groups?

Appendix 5. Survey

Dear [*course name*] student,

This survey is designed for further improvement of the [*course name*] course. The survey is centered around two main topics. The first topic deals with the **interactions with your tutor and peers**. The second topic deals with the **general course setup**.

Online tutoring is an under-researched area, and your answers will contribute to the current understanding of the online tutor's role.

The survey includes both closed and open questions. Please answer as detailed as you can. It will take around 20 to 30 minutes to fill out the entire survey. The language of the survey is English. However, you are welcome to use Norwegian in open questions if you are more comfortable with that.

Your input is extremely valuable. Thank you for participating!

Before starting the questionnaire, we would like to ask you a few quick questions related to your background.

1. Please indicate your gender:

- (1) Male
- (2) Female

2. Please indicate your age:

- (1) Less than 20
- (2) 20-30
- (3) 31-40
- (4) More than 40

3. Is Norway your country of origin?

- (1) Yes
- (2) No

4. Have you taken online collaborative courses before?

- (1) Yes
- (2) No

5. How long experience do you have using learning management systems (e.g., Fronter, It's learning, Moodle, Blackboard, or the like?)

- (1) Less than 1 year
- (2) 1-2 years
- (3) More than 2 years

Online tutor

In this section we will ask you several questions related to your online tutor. Please note that the online tutor [*name*] here is distinguished from the designer and main teacher of the course [*name*]. Instead of actually teaching, the tutor is the one **guiding** the students through the activities planned by the course teacher.

6. Put the following roles of the online tutor in order of importance for you:

	1	2	3	4
Technical (guiding you through the use of the technology, providing links to additional tools and tutorials)	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>
Managerial (reminding you of the deadlines, managing the norms of behavior in the group, guiding you through the course structure and task requirements)	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>
Pedagogical (helping you understand the content, keep the discussion in the right direction and reflect; providing you with additional resources and feedback; discussing different perspectives and argumentation)	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>

	1	2	3	4
Social (creating friendly environment and promoting interpersonal interactions, learning with you and from you, motivating you, helping you handle conflicts)	(1) <input type="checkbox"/>	(2) <input type="checkbox"/>	(3) <input type="checkbox"/>	(4) <input type="checkbox"/>

7. What specific actions of the online tutor have you experienced as most beneficial for you? Please select from one to five answers:

- (1) Explaining aspects of the course content
- (2) Providing guiding questions
- (3) Providing additional materials
- (4) Pointing out the areas for improvement
- (6) Providing feedback after the task completion
- (7) Helping to handle conflicts in the group
- (5) Encouraging your participation
- (8) Promoting social interactions
- (9) Reminding you of the deadlines
- (10) Guiding you through the course structure and assignment requirements
- (11) Helping you to use the technology
- (12) Acknowledging your work
- (13) Providing individual support
- (14) Other (please specify) _____

8. In your opinion, what specific actions the online tutor should have undertaken more? Please select from one to five answers:

- (1) Explaining aspects of the course content
- (2) Providing guiding questions
- (3) Providing additional materials
- (4) Pointing out the areas for improvement
- (6) Providing feedback after the task completion
- (7) Helping to handle conflicts in the group
- (5) Encouraging your participation
- (8) Promoting social interactions
- (9) Reminding you of the deadlines
- (10) Guiding you through the course structure and assignment requirements
- (11) Helping you to use the technology
- (12) Acknowledging your work

- (13) Providing individual support
 (14) Other (please specify) _____

9. Please use the comment field below to elaborate on your choice:

10. How often would you like the online tutor to post in your discussions, and what does it depend on?

11. During the discussion, what is the ideal feedback you can get from your online tutor?

12. After submitting an assignment, what is the ideal feedback you can get from your online tutor?

Interactions with your peers

In collaborative learning interactions with peers are very important. Therefore, we would like to ask a few things about how it was for you to learn in a small group together with other students.

13. What do you think about the collaboration in your group? Please evaluate the following statements on a scale from 1 to 7 where 1 is "strongly disagree" and 7 is "strongly agree":

	1			4			7
	Strongly disagree	2	3	Neutral	5	6	Strongly agree
My postings were respected by the tutor	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
My postings were respected by my peers	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Postings made by me and others in the course room were treated as equally important by the tutor	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Postings made by me and others in the course room were treated as equally important by my peers	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>

	1 Strongly disagree	2	3	4 Neutral	5	6	7 Strongly agree
My peers and I had shared values	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
The atmosphere in my group was open for me to express my opinions	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
My individual characteristics and qualities were acknowledged by the tutor	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
My individual characteristics and qualities were acknowledged by my peers	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
I learned about my peers and tutor through their sharing of personal experiences and emotions	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
There have been some misunderstanding due to the differences in our cultural background	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>

14. For the statements where (and if) you selected "strongly disagree" or "strongly agree", please state your reasons for this:

Course setup

The final section deals with the course setup and the main online learning environment Fronter.

15. How would you evaluate Fronter as a tool in the E-teaching I course? Please evaluate the following statements on a scale from 1 to 7 where 1 is "strongly disagree" and 7 is "strongly agree":

	1	2	3	4	5	6	7
	Strongly disagree			Neutral			Strongly agree
Using Fronter makes it easier for me to perform in the course	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Using Fronter increases the quality of my contribution in the course	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Using Fronter decreases my effectiveness in the course	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Interaction with Fronter is clear and understandable	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Working on Fronter is complicated and it's not always easy to grasp what's going on	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
I have control over using Fronter	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
Assistance on using Fronter was available (if I needed it)	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>
It is easy to interact with peers in Fronter	(8) <input type="checkbox"/>	(9) <input type="checkbox"/>	(10) <input type="checkbox"/>	(11) <input type="checkbox"/>	(12) <input type="checkbox"/>	(13) <input type="checkbox"/>	(14) <input type="checkbox"/>

16. Please fill in a few sentences where you explain what kind of tasks you liked most in the course, and why:

17. Would you like to have better opportunities to interact with your peers on activities not specifically related to the learning tasks, and why?

18. Have you ever felt that your written text was misinterpreted by a peer?

- (1) Yes
- (2) No
- (3) I don't know

19. Do you think regular synchronous online meetings in your small group would be useful?

- (1) Yes
- (2) No
- (3) I don't know

20. If such meetings are organized, would you like the tutor to participate in these meetings?

- (1) Yes
- (2) No
- (3) I don't know

21. If such meetings are organized, how often do you think they should happen?

- (1) Weekly
- (2) Twice per month
- (3) Monthly
- (4) Every other month
- (5) Other (please specify) _____

Thank you!

Thank you for your contribution, we appreciate you took the time to answer our questions! Press "Finish" to submit your answers.

Appendix 6. Course Evaluation Survey

Dear [course name] course participant!

As part of starting up the [course name], we would like you to reflect on what you have already learned in the [course name] - in line with the socio-constructivist pedagogy. In this form, we will ask you eight open questions where you could write down your reflections. The questions should take you approximately 15 minutes to answer.

All the responses will be collected anonymously, and your identity will not be revealed.

Off we go!

First, we would like you to reflect on the setup and format of the course.

1. Was it difficult for you to understand how you are supposed to follow the course?

2. Have you understood the essence of collaborative learning? Do you think it is beneficial, and if so, what are the key benefits?

3. How dependent do you think you and your group were on the tutors' involvement?

4. Have you experienced any intercultural differences? Were there any challenges and lessons learned in the process?

5. Do you think you used between the stipulated 250-300 hours for 10 ECTS, or was it much more or much less?

Second, we would like you to reflect on the course outcomes.

6. Have you learned anything new and useful in the course? Please point out three or more aspects that you consider most useful:

7. Do you think you have reached the intended learning outcomes?

8. Do you think you'll be using anything from the [course name] in your own work? If yes, could you elaborate what exactly it would be?

Thank you very much for taking the time and reflecting on the course. We highly appreciate your valuable input!

We are looking forward to collaborating with you in the [course name]. **Please press the "Finish" button below to submit your answers.**

Appendix 7. Coding Scheme

The original framework of Curtis and Lawson (2001) was used. Two categories were added (marked with asterix; “monitoring presence” and “emotion expression”) to describe certain interactions that did not fit any of the categories in the original framework.

Parent category	Category	Detailed description	Example
Planning	Organizing work (OW)	Planning work in a group; setting shared tasks and deadlines; splitting the tasks; monitoring current understanding of the task	“Add a comment if you think something should be removed or modified” (S21)
	Initiating activities (IA)	Initiating a move to a particular part of the task as a group	“Should we just go through the document?” (S22)
Contributing	Sharing knowledge (SK)	Making a content-related proposal by sharing a piece of knowledge with a group; discussing content-related information; sharing personal experience related to the content	“Yes, earlier you had to pay if you were more than two with a web camera, but it has changed now” (S08)
	Feedback giving (FBG)	Providing explicit feedback on ideas by others	“Hmm, I’m trying to think what could be added, but you have mentioned the most important things” (S08)
	Challenging others (CH)	Challenging the contributions of peers; asking for personal experiences	“This is too easy, everyone is using that” (S23)
	Explaining and elaborating (EX)	Explaining and defending a specific proposal – mainly after being challenged by a peer	“But it is incredibly good software for synchronous discussions” (S21)
	Exchanging extra resources (RES)	Providing links to supporting information to peers; pointing to helpful resources	“There’s a video which explains it on their webpage” (S21)
	Help giving (HEG)	Responding to peers’ questions related to the tools in use, task, etc.	“Should be 700 words in total” (S24)
Seeking input	Feedback seeking (FES)	Asking feedback related to the content of the task, a particular proposition made, etc.	“I’m writing mainly about Docs, but maybe mentioning too much about Word/Microsoft?” (S08)

	Help seeking (HES)	Asking for help on the tools in use, task, etc.	“Are we supposed to write in English?” (S17)
	Advocating effort (EF)	Urging peers to contribute with a specific idea, edit or action	“Just write this in the document” (S14)
Reflection & Monitoring	Monitoring group effort (ME)	Comments on group’s processes, current achievements, including comments on own processes and informing the group about them	“554 words now, this should be fine” (S09)
	*Monitoring presence (MP)	Reporting on own or other peers’ presence in the discussion; making oneself “visible”; logging in and access issues	“I think we are missing Christopher?” (S03)
Affective & Social	*Emotion expression (EMO)	Emotions (words, emoticons, abbreviations, etc.)	“Great!” (S17)
	Social interactions (SI)	Sarcasm, jokes, references to memes, etc.	“Good to have some time pressure, adds some excitement to the everyday life” (S08)

Appendix 8. Coding Scheme

The framework of Gunawardena et al. (1997), later employed and elaborated by Hull and Saxon (2009), was used. In this project, the framework was further adjusted to cover all the utterances produced by the participants. For example, Phase I—“coordination moves”—was added.

Phase I: Coordination moves (posting the task, coordinating learning activities, taking turn, social contributions, prompting peers to contribute, discussing and clarifying task instructions)
Phase II: Sharing new information without reference to previous contributions made by peers (information is provided that has not been previously discussed; a statement of observation or opinion, or information found from learning materials such as literature)
Phase III: Situated definition (information is validated through a socially-shared, distributed consciousness)
<ul style="list-style-type: none"> a. A statement of agreement b. Providing corroborating example(s), expanding previous ideas with more knowledge c. Providing encouragement for previously expressed ideas d. Basic questions of clarification
Phase IV: Dissonance (inconsistency between a new observation and the learner’s existing knowledge, inconsistency among ideas)
<ul style="list-style-type: none"> a. Identifying or stating areas of disagreement b. Restating the participant’s position, and possibly (not necessarily) advancing arguments or considerations in its support by references to the participant’s experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view
Phase V: Negotiation of meaning and co-construction of knowledge (higher mental functioning that attempts to bridge differences in situated definitions)
<ul style="list-style-type: none"> a. Negotiation or clarification of the meaning of terms b. Proposal and negotiation of new statements embodying compromise, co-construction; integration of ideas c. Negotiation of the importance (relative weight to be assigned to) of different arguments provided
Phase VI: Testing tentative constructions (testing new ideas developed through the discussion in the group)
<ul style="list-style-type: none"> a. Testing the proposed synthesis against “received fact” as shared by the participants and/or their culture b. Testing against personal experience
Phase VII: Agreement statement(s) and application of newly constructed meaning
<ul style="list-style-type: none"> a. Summarization of agreement(s) after some dissonance and negotiation b. Metacognitive statements by the participants illustrating that their understanding, knowledge or ways of thinking (cognitive schema) have changed as a result of the online interaction

Appendix 9. Collaboration Script (Lazareva, 2017c)

Instruction	Mode	Time
When all have joined the Google document, individually read the whole instruction.	†	5 min
Make sure all group members have the same understanding of the task.	† † † †	5 min
Split tasks in your group. Who will be looking for tools supporting... <ol style="list-style-type: none"> 1. collaborative writing? 2. asynchronous discussions? 3. synchronous discussions? 4. shared file repository? 	† † † †	10 min
Individually explore corresponding tools. Use the suggestions from the lecture, and/or make your own suggestions based on the tools you know/have used. Select one.	†	15 min
In turn, each of you presents the chosen tool in the document chat, explaining the arguments for your selection. The rest of the group comment on the choice. Discuss and reach an agreement on each of the tools.	† † † †	30 min
Individually, write down your text part, describing the key features of the tool and integrating the argumentation from your discussions.	†	20 min
Individually, go through the whole text and comment where you want to modify using the note function.	†	15 min
Individually fix your part of the text.	†	10 min
Final check your document together and submit.	† † † †	5 min

Appendix 10. Collaboration Script (Lazareva, under review)

Step	Mode	Hints
<p>1. <i>Split the roles in your group</i></p> <ul style="list-style-type: none"> • Moderator (who will also be the weaver) (one person) • Discussion initiator (one person) • Critics (the rest of the group) 	Group	
<p>2: <i>Individually search for information online</i></p> <ul style="list-style-type: none"> • What is scaffolding? How is it implemented in practice? • What is peer teaching? How is it implemented in practice? <p>Take your notes, but don't yet write on the forum</p>	Individual	<p><i>Sources</i></p> <ul style="list-style-type: none"> • Google Scholar (save references!) • Concept map • Video lecture on online tutoring
<p>3: <i>With your peers, define the key concepts</i></p> <p>Play out the assigned roles</p> <ul style="list-style-type: none"> • Discussion initiator posts his/her findings on the questions under two corresponding threads “Scaffolding” and “Peer teaching” • <u>Each</u> critic responds to both initiator's posts trying to challenge the proposal. Is there something unclear? Is there something that could be removed, replaced, or added? • Then, <u>all group members</u> engage in debate. No question should remain unanswered • When the moderator considers the debate sufficient, he/she synthesizes the contributions and produces the final summary defining scaffolding and peer teaching 	Group	<p><i>Note for the initiator:</i> your initial contributions are the key as the rest of your group are going to build on them. Try to include key information but try to be rather brief.</p> <p>During the debates, try to defend your position and elaborate on possible uncertainties posed by the critics.</p> <p><i>Note for critics:</i> your task is to challenge the initiator in order to complement the group's understanding of key concepts.</p>
<p>4: <i>With your peers, formulate three important ways to support online students</i></p> <p>Play out the assigned roles</p> <ul style="list-style-type: none"> • Discussion initiator posts their proposal under the thread “Three important ways to support online students” with a brief argument for why these were chosen • <u>Each</u> critic responds to the initiator's post trying to challenge the proposal. Is there 	Group	<p>During the debates, engage actively also with other critics.</p> <p><i>Note for the moderator:</i> what you're seeking for is the balance – how to bring your peers' points of view together?</p> <p>During the debates, keep that in mind and try helping your peers reach an agreement.</p>

<p>something unclear? Is there something that could be removed, replaced, or added?</p> <ul style="list-style-type: none"> • Then, <u>all group members</u> engage in debate. <p>No question should remain unanswered</p> <ul style="list-style-type: none"> • When the moderator considers the debate sufficient, he/she synthesizes the contributions and produces the final summary defining three important ways to support online students 		
<p><i>5: The weaver creates a deliverable and uploads to the archive</i></p>	<p>Individual (weaver)</p>	

Appendix 11. Thesis publications

Following research articles are included in the appendix:

1. Lazareva, A. (2015). [Promoting collaborative interactions in a learning management system](#). *Proceedings of the 2015 International Conference on Interactive Collaborative Learning (ICL)*, pp. 421–430. IEEE.
2. Lazareva, A. (2017). [Role of the online tutor in establishing social presence in asynchronous text-based collaborative learning environments](#). In M. E. Auer, D. Guralnick, & J. Uhomoibhi (Eds.), *International Conference on Interactive Collaborative Learning* (pp. 128–142). Cham: Springer.
3. Lazareva, A. (2017). [A framework for small group support in online collaborative learning: Combining collaboration scripts and online tutoring](#). *Proceedings of the 9th International Conference on Computer Supported Education (CSEDU)*, pp. 255–262. SciTePress.
4. Lazareva, A. (2017). [Facilitating synchronous collaborative writing with a collaboration script](#). In N. Paspallis, M. Raspopoulos, C. Barry, M. Lang, H. Linger, & C. Schneider (Eds.), *Information Systems Development: Advances in Methods, Tools and Management (ISD2017 Proceedings)*. Larnaca: University of Central Lancashire Cyprus.
5. Lazareva, A., & Munkvold, B. E. (2017). [Facilitating collaboration: Lessons learned and mutual synergies in collaboration engineering and computer-supported collaborative learning](#). *International Journal of e-Collaboration*, 13(3), 22–38.
6. Lazareva, A. (under review). Fostering transactivity in asynchronous student discussions through role scripting. Submitted to *Computers & Education*.

