Team-skills training and real-time facilitation as a means for developing student teachers' learning of collaboration

Ela Sjølie [a, *], Alex Strømme [b], Juliette Boks-Vlemmix [b]

[a] Norwegian University of Science and Technology, Department of Industrial Economics and Technology Management, 7491, Trondheim, Norway
[b] Norwegian University of Science and Technology, Department of Teacher Education, 7491, Trondheim, Norway

HIGHLIGHTS

- 257 student teachers carried out a group task at two different levels of intervention.
- Significant differences between the intervention group and the control group.
- Importance of stimulating students to talk about their collaboration.
- Need for task designs that *explicitly* focus on learning to collaborate.
- Student teachers need to cultivate a language around the subject of collaboration.

ARTICLE INFO

ABSTRACT

This mixed-methods study investigates whether and how team-skills training and real-time facilitation can enhance students' learning of collaboration. Two hundred and fifty-seven student teachers carried out a group task at two different levels of intervention. The findings show that the intervention had a positive impact on the students' perceived learning outcomes and on stimulating group reflection. We also identified four enabling structures of the task design. The study contributes to literature on *how* collaborative learning activities in higher education can be facilitated and argues that cultivating a language around the subject of collaboration is a prerequisite for developing transferrable collaborative skills.

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1. Introduction

The ability to collaborate is of increasing importance in today's society and work life, and therefore also in schools. Collaboration is important to teachers' professional learning (Sjølie, Francisco, & Langelotz, 2019), and is seen as a predictor of success in school development (Kennedy, 2014; Opfer & Pedder, 2011). This implies that teachers need to be able to work in teams, within and across disciplines and professions. Teachers are also expected to teach their own students to collaborate, particularly because collaboration is highlighted as one of the essential skills of the 21st century (Binkley et al., 2012; Dede, 2010). Many researchers have therefore argued that cultivating collaborative skills within the curriculum of teacher preparation is important (e.g. Häkkinen et al., 2017; Rigelman & Ruben, 2012; Veenman et al., 2002).

Collaborative learning is a valued educational approach that is often used to promote such collaboration skills. A large body of research has shown its positive effects on academic and social learning (Kyndt et al., 2013). Little research has, however, been conducted into how to support collaboration as an educational outcome in its own right. It seems to be taken for granted in much of the literature that a group that works efficiently together will lead to enhanced learning, with the students "automatically" becoming effective collaborators. The argument in this paper is that becoming a good collaborator requires an *explicit* focus on collaboration, which includes to talk about and reflect upon their collaboration as it happens. Reflection on collaboration as an explicit topic is almost non-existent in the literature on collaborative learning. In this paper, we report from an intervention study, in

* Corresponding author.
E-mail addresses: ela.sjolie@ntnu.no (E. Sjølie), alex.stromme@ntnu.no (A. Strømme), juliette.boks@ntnu.no (J. Boks-Vlemmix).

which we applied teamwork pedagogies to facilitate student teachers' collaboration skills. We ask: *to what extent and how can team-skills training and real-time facilitation stimulate group processing and students' ability to articulate collaboration*? We compared three cohorts of students who carried out the same group task at different levels of intervention.

The paper begins by locating the study in the abundant literature on collaborative learning. This is followed by an elaboration on two key topics in the paper: articulating collaboration as a collaborative skill and facilitation. We then describe the study and report on the findings. Finally, we discuss the findings and indicate implications for teacher education.

1.1. Research on collaborative learning

The majority of empirical research on collaborative learning has investigated the effectiveness of collaborative learning as a method and revealed that this method promotes academic achievement and social and collaborative skills (Kirschner et al., 2009; Kyndt et al., 2013; Ruys et al., 2014). It has been found that collaborative learning can contribute to the acquisition of a variety of knowledge and skills, including higher-order thinking, metacognitive skills (Johnson & Johnson, 2009), social-emotional functioning (e.g. Gillies et al., 2008), openness to diversity, and inter-professional competence (e.g. Lakkala et al., 2017; Loes et al., 2018). Studies that have investigated the student perspective show that students value working with others (Ahonen & Kinnunen, 2015; Ruys et al., 2010). It is fair to conclude, from the abundant literature on collaborative learning, that it is a highly valued method for students and for teachers. As teacher educators, however, we encounter students who have had a variety of experiences with group work, the most common challenge being students who do not contribute sufficiently, so-called *free-riders* (Hammar Chiriac, 2014; Peterson & Miller, 2004). Other challenges include disagreements or conflicts within groups, poor communication or lack of leadership (De Hei et al., 2015; Hassanien, 2006). Most researchers agree that placing students in small groups does not guarantee learning. Productive learning does not take place if collaboration is not sufficiently supported, and students can ultimately have negative learning experiences (Häkkinen et al., 2017).

Interest in the teacher's role in promoting student activities and fostering effective collaboration has therefore been increasing. Researchers have focused on pedagogical design, such as task design (e.g. Lockhorst et al., 2010), group composition (e.g. De Hei et al., 2018), structuring group interaction, and assessment (De Hei et al., 2016; Webb, 2009). One of the most common challenges reported relates to supporting the students' collaborative process. Kreijns et al. (2003) found neglect of the psychological dimension of the desired social interaction, such as group cohesion, trust, respect, and belonging, to be a pitfall of teacher-designed collaborative learning. Many things can go wrong in collaboration, even when carefully designed. This therefore calls for the presence and support of the teacher *during* group work (Häkkinen et al., 2017). Researchers, however, emphasize that such support can be difficult. For example, De Hei et al. (2015) studied university lecturers' implementation of collaborative learning and identified teachers' limited coaching skills and lack of competence in facilitating collaborative work as the main barriers. Liebech-Lien and Sjølie (2020) found in their study of secondary school teachers that the teachers understood collaborative learning as a way of organizing students. They also found that the teachers believed they were inadequately prepared for teaching students how to collaborate.

In conclusion, many researchers argue that becoming an effective collaborator is not intuitive. Collaborative work needs to be facilitated and students need to be prepared so that they can develop the skills necessary to interact effectively in a group (e.g. Blatchford et al., 2003; Gillies & Boyle, 2011; Pellegrino & Weiss, 2017; Webb, 2009).

1.2. Preparing for and facilitating student collaboration

Many universities offer specific training in team-skills to prepare students for collaborative work. Those advocating for the importance of this training have argued that this facilitates group functioning (Prichard et al., 2006). Good group functioning is believed to result in more effective groups, which in turn facilitates learning. Prichard et al. (2006) looked at the effect of team-skills training upon pre-service teachers. They found that groups that had participated in team-skills training achieved significantly higher performance than groups that had not. They also found that these benefits were lost when the groups were re-formed after one semester. They attributed this finding to insufficient training and the lack of development of generic skills, which are transferrable from group to group or to a future work setting. In a school context, Kutnick and Berdondini (2009) found that students who had participated in relational training to enhance collaborative skills demonstrated higher levels of participation in group work, on-task focus, symmetric co-regulated communication, and lower levels of social distraction than peers who had not received this training. The above studies are part of a small but growing body of evidence that indicates that team skills training enhances collaborative group outcomes.

Social interdependence theory, which underpins much of the literature on collaborative learning, maintains that groups that discuss their interactions and how they might improve them, function most effectively (Johnson & Johnson, 2009). This is often called group processing. Sutherland, Stuhr & Ressler (2019) argue that group processing, despite its pivotal role in collaborative learning, is often forfeited due to lack of time or because of the misguided teacher notion that discussions on group functioning will happen automatically. This is supported by Fransen et al.'s (2011) study on pre-service teachers, which found that student teams tended to be pragmatic and focused primarily on the task aspects of performance and not team aspects.

In sum, previous research studies have recognized that collaboration needs to be supported, that students need to be prepared for collaboration (e.g. team-skills training), and that group processing is critical for group effectiveness. Much has been written about the importance of these three aspects. However, little research has been conducted on *how* this can be achieved and the influence this can have on students' learning outcomes. There is a particular lack of process-oriented research into the development of transferable, collaborative skills that students can apply to future team contexts and to the classroom (Borrego et al., 2013; Näykki et al., 2017). Group processing or reflection on collaboration is, as an explicit topic, almost non-existent in the literature on collaborative learning.

The main focus of research into collaborative learning has been group *effectiveness*. The argumentation seems to be that groups that work efficiently and smoothly together will achieve enhanced academic and social learning. The expectation is that the more opportunities students are given to collaborate in groups and the more effective this collaboration is, then the more developed their collaborative skills will become — skills that can be transferred to new groups. In other words, it is presupposed that the learning of collaborative skills is experiential in nature, and that students are "learning by doing collaboration" (cf. Dewey, 1986). However, reflection is an essential step in experiential learning. Although people *do* learn intuitively from experience, there is often a need in

a learning setting to facilitate reflection to enable students to draw learning from experience. There is also a need to facilitate conversations about the group's collaboration (group processing). Individuals in a group that are left to process the experiences of the collaboration themselves will often base their "learning points" merely on assumptions about the others in the group and what they experienced.

It is particularly important that students who are preparing to become teachers understand *why* some collaborations work well and others do not. For example, why did one group member withdraw from the group (the so-called free-rider)? Is she just a lazy person or was it because of something that happened in the group? Teachers are not only expected to work in teams themselves, but are also expected to be able to facilitate collaboration between their students. They therefore need *to cultivate a language around the subject of collaboration* (i.e. to understand and be able to talk about what is happening in a group). In this study, we argue that being able to articulate collaboration is a collaborative skill, and we explore whether and how team-skills training and real-time facilitation can contribute to the development of this skill.

1.3. Articulating collaboration—a collaborative skill

The intervention studied in this paper focuses on stimulating group processing and student reflection on the group's functioning. The underlying argument is that being able to articulate and learn from experiences with collaboration is a prerequisite for developing transferrable collaborative skills. The teaching design of the intervention is based on Kolb's (2014) four-stage learning cycle. *Concrete experiences* of collaboration form the basis for *reflection on experience* and *abstract conceptualization*, which in turn can lead to *active experimentation* and actions. We acknowledge that these steps are not necessarily sequential. However, all four stages are important in the process of learning from experiences with collaboration in a way that can be transferred to future settings. The underlying assumption is that *awareness* of the group's dynamics and oneself as a group member are both crucial. Actions that can improve a group's work can only be taken where a person and a group become aware of the interactions between the group members. Such awareness can be built through feedback on specific situations, given by other group members or by a teacher or facilitator. One consequence of this is that articulating collaboration includes the ability of students to give and receive feedback, which has also been emphasized as an important element of effective collaboration (e.g. Fransen et al., 2011; Stone & Heen, 2015).

In this paper, we consider being able to articulate collaboration to be a collaborative skill in itself. We use three criteria to describe the students' learning outcome related to this. The students should: 1) gain **insight** into their own behavior patterns and attitudes, and into those of others, 2) be able to give and receive **feedback** on behavior in the group, and 3) be able to analyze their own teamwork and **reflect** on how they communicate, plan, decide, accomplish tasks, handle disagreements and relate to professional, social, and personal challenges.[1] Based on this insight, feedback, and reflection, they should then be able to take actions to change behaviors or patterns of interaction if necessary. The aim is also that they are able to transfer this learning to future collaborations.

1.4. Facilitation of groups

Facilitation is a term that is widely used in many areas. It is

used in organizations, therapeutic and social work, and in education. It has recently grown into both a profession and a discipline (Hogan, 2005). The word is used differently in different areas and has also become part of our everyday language. There is therefore a need to elaborate on what we mean by *facilitator* or *facilitating* in the context of student collaboration. The Latin root of the word (*facilis)* means "to enable" or "to make easy." In education, facilitation is often used in the context of "facilitating learning". There is no agreed-upon definition of the words facilitation and facilitator. Hogan (2005) notes that "facilitation is concerned with encouraging open dialogue among individuals with different perspectives so that diverse assumptions and options may be explored" (p. 10). A facilitator is an individual who enables groups to collaborate well and work more effectively together. A facilitator can also be focused on developing awareness and enabling learning. Kaner (2007) describes the facilitator as follows:

> She or he is a "content-neutral" party who, by not taking sides or expressing or advocating a point of view during the meeting, can advocate for fair, open, and inclusive procedures to accomplish the group's work. A facilitator can also be a learning or a dialogue guide to assist a group in thinking deeply about its assumptions, beliefs, and values and about its systemic processes and context. (p. Xv).

The word "content-neutral" implies that the facilitator's main focus is on the group *process* rather than on the content or topic of the work.

The presence of a person from outside the group is helpful. However, groups mostly work alone, and the group then has to self-facilitate. Collaboration skills are therefore also about learning to become *facilitative* as individuals and as a group. According to Kaner, a *facilitative individual* is easy to work with and is *aware* of individual and group dynamics. It also includes, we argue, that he or she can talk about or *articulate* collaboration. A *facilitative group* is a group that works well together and in which facilitative mind-sets and behaviors are widely distributed across the members (Kaner, 2007). The literature on collaborative learning is, to a great extent, isolated from the team literature (Borrego et al., 2013; Prichard et al., 2006). The topic of facilitative mind-sets and behaviors is therefore an aspect of collaboration skills that is not mentioned in the research literature on collaborative learning.

Facilitation is used in the intervention described in this paper as a means to stimulate group processing and reflection. Facilitation has three aims, the first two being most in focus: a) stimulate (self)-reflection and insight/awareness, b) stimulate continuous evaluation of group functioning (group processing), and c) increase group effectiveness. We describe how the study was conducted and the context in more detail below.

2. Method

2.1. Context of the study

The study was conducted with students from two different teacher education programs at a Norwegian university: a five-year master's program in which teacher education and disciplinary studies were integrated and a one-year Postgraduate Certificate in Education (PGCE). The overall content and expected learning outcome of the programs are the same, following the National curriculum for teacher education in Norway. For one semester, students from these two programs meet and follow the same courses, however with slightly different time schedule and

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[1] These are similar to the learning outcomes of the course "Experts in teamwork" that is referred to in the methods section. https://www.ntnu.edu/eit.

dedicated teaching staff.[2] A major element in this semester is a group-based project, which has been a part of both teacher education programs since 2007. In this project, the students are placed in groups and are expected to define a "research question" that can be explored during their school practicum. The groups are composed following two criteria: 1) mixing students from different disciplines and 2) including students placed at the same school. Depending on how these criteria can be met, the group size varies from 4 to 6 students. Each group is assigned a supervisor (a teacher within the teacher education program). The role of this supervisor is to guide the students in their work from defining the topic to collecting data and writing up the results, and also to support the collaborative processes. The students are assessed as a group, and the assessment is based upon two group reports: a "traditional" academic *project report* describing their project and a *process report* describing their collaboration. In the process report, the student groups select situations from their group work and discuss them in the context of relevant group dynamic theory. The aim of the process report is that the students should become aware of the group's dynamics and themselves as group members, for example in terms of roles in the group, levels of contribution, and decision making. In the process report, they should not only be able to *identify* what happened in the group but should also *reflect* on which actions were helpful and unhelpful and thereby be able to transfer this knowledge to new group compositions in their own future classrooms. The students should therefore, in light of our previous description of desired learning outcomes related to collaboration, gain *insight* into their own behavior patterns and those of others, as well as be able to analyze and *reflect* on their teamwork.

However, the experiences gained from running these two teacher education programs over many years show that students do not achieve these learning outcomes. It has been assumed that this is mainly because the group process has only been fully addressed at the end of the semester during the writing of the process report. Furthermore, the supervisors have primarily been engaged with guiding the academic part of the project, and have been less involved with the groups' collaboration. Challenges that the students face, such as so-called free-riding, might have been raised with the supervisors, but often too late in the semester to do much about it. Although we have not conducted research on these supervisors' experiences, the lack of focus on facilitating the students' collaboration can be seen in light of research findings showing that teachers often have limited competences in facilitating collaborative work (cf. De Hei et al., 2015). An intervention was therefore designed to stimulate group processing and the students' reflection on the group's functioning *as it happened*, aiming to improve the students' learning outcomes related to collaboration.

2.2. The intervention

The intervention included three different groups of students, here referred to as Cohort 1 (A and B) and 2. Cohort 1 included 116 students from the five-year program, while Cohort 2 consisted of 141 students from the PGCE program. To keep the intervention manageable and to take advantage of the possibility to evaluate the intervention with a control group, Cohort 1 was chosen for the intervention and Cohort 2 as control group. Cohort 1 was in turn divided into two sub-cohorts 1A and 1B, being subject to two different levels of intervention. An overview of the intervention and

data collection is illustrated in Fig. 1.

The intervention consisted of two main components: 1) team-skills training (1A and 1B) and 2) "real-time" facilitation (1A). The team-skills training consisted of lectures on the theory of group dynamics, as well as activities that allowed the students to practice different tools for group processing and reflection on collaboration. For example, the students learned how to write individual reflections and use these for group reflection; they had to write a collaboration agreement, and they were trained in how to give *and* receive feedback on behavior in the group. The intention was that these activities would support the students in writing the final process exam report. As illustrated in Fig. 1, team-skills training included one lecture and three seminars. The real-time facilitation was done only with cohort 1A, consisting of seven groups. Instead of participating in the third seminar, the groups were observed and facilitated during three group work sessions during the semester (see Fig. 1). Each group was assigned two facilitators who observed the students while they were working on the project. Both parts of the intervention (team-skills training and real-time facilitation) were led by trained facilitators. These were students from other programs who had been trained in the "Experts in teams" course at the same university (Sortland, 2015).[3] The facilitators had been trained to observe groups, share observations with the group, and ask open-ended questions. The open-ended questions were designed to encourage the groups to talk about these observations and react by changing their behavior if the group deemed this necessary. The students in cohort 2 were given the same type of group-based project and assessment criteria as cohort 1. They were offered the same literature and the first lecture on group dynamic theory. However, they did not participate in the seminars or have facilitated group work sessions.

2.3. Research design

A mixed-methods design was employed, using a combination of sequential explanatory design and convergent parallel design. A sequential explanatory design is characterized by a first phase of quantitative data collection and analysis, followed by a second qualitative phase that aims to explain, or elaborate on, the quantitative results (Ivankova et al., 2006). Parallel convergent design occurs when qualitative and quantitative data are collected and analyzed within the same timeframe and kept as independent strands during analysis (Creswell & Clark, 2011). In this study, the quantitative and qualitative data were collected within the same period, which implies a convergent design. However, the analysis of the quantitative data was conducted first and informed the analysis of the qualitative data (as in explanatory design). At one point, we also returned to the quantitative data to corroborate a finding from the qualitative analysis. The rationale for this approach was to explain the statistical results by exploring the students' experiences in more depth. As our purpose was to understand *how* to support students' learning of collaboration, priority was given to the students' experiences and thus to the qualitative data.

2.3.1. Quantitative data and analysis

Quantitative (survey) data were collected from all three cohorts (1A, 1B, and 2). With the questionnaire, we sought to analyze the impact of the intervention by exploring differences between the cohorts related to the overall aim to cultivate the ability to articulate and reflect upon collaboration. Questions were constructed to align with the three criteria outlined in section 1.3: 1) insight, 2) feedback and 3) reflection (group processing). In addition, the

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[2] For the PGCE program, this occurs in the 2nd semester; for the five-year master's program this occurs in the 8th semester.

[3] This course has an explicit focus on learning to collaborate in interdisciplinary teams. For details, see https://www.ntnu.edu/eit.
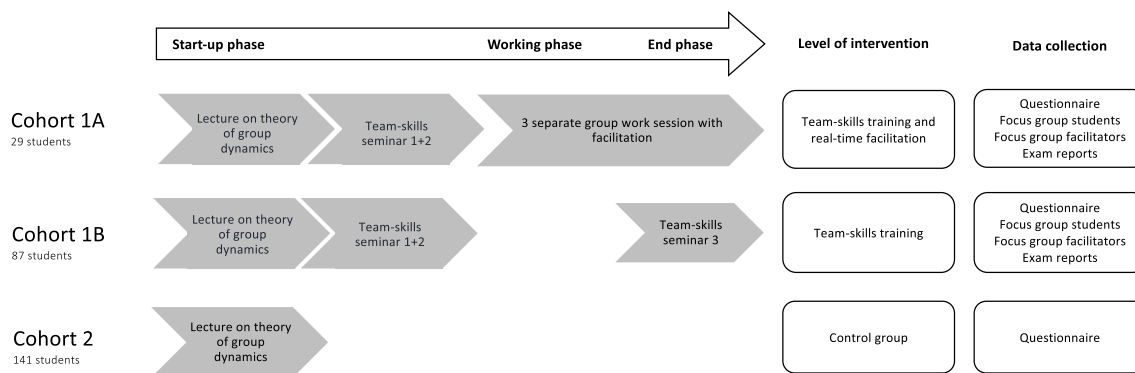
Fig. 1. Overview of the intervention and data collection for the different cohorts.

Table 1

The four scales with example item and Cronbach's α.. Answering categories were on a Likert scale from 1 to 7. Two variations were used: very small extent (1) to very large extent (7), or very bad (1) to very good (7).

	Example item	Items	α
Overall learning outcome	How do you evaluate your own learning outcome from the R&D project?	3	.851
Insight (about self and others in a group)	I have gained more insight into how my behavior affects others in the group.	5	.897
Feedback (giving and receiving feedback)	To what extent have you made use of the feedback you have received?	4	.772
	To what extent did you reflect together on patterns of communication in the team?	6	.901
Group processing (reflecting on collaboration together as a group)			

questionnaire included questions about the students' overall learning outcomes. The questions relating to *overall learning outcome* and *insight* aimed to measure the students' *perceived* learning. The questions relating to feedback and group processing aimed to answer to what extent the students had given each other *useful* feedback and actually talked about and reflected on their collaboration *while* they were working (and not only at the end when compiling the process report). Table 1 shows the four scales with example items.

The questionnaire was distributed at a lecture at the end of the semester, which all students were expected to attend. The response rate was 64 % for cohort 1 (22 male, 51 female) and 54 % for cohort 2 (37 male, 39 female).

Descriptive statistics were calculated for all variables, and internal consistency of the four scales was calculated by means of Cronbach's α. An analysis of variance (ANOVA) was performed to determine the impact of the intervention on the three groups. Bonferroni post hoc tests showed significant differences between cohort 1A/1B and 2, but no significant differences between 1A and 1B (the two groups that were involved in the intervention). Therefore, cohort 1A and 1B were merged, and independent samples tests were performed between cohort 1 and cohort 2. Levene's test confirmed that the cohorts had equal variances. We also computed Cohen's d effect sizes using Lenhard and Lenhard (2016).

2.3.2. Qualitative data collection and analysis

We sought to answer how and why the intervention might have worked (or not) by exploring the students' experiences using the qualitative data; we therefore only used data from cohort 1. Three focus group interviews were conducted: one focus group with eight students from cohort 1A (4 female, 4 male), one focus group with six students from cohort 1B (4 female, 2 male), and one focus group comprised of six of the facilitators (1 female, 5 male). The facilitators were included to represent the teacher's perspective. All three authors took part in the data collection, with two of us present for each interview. The interviews lasted from 90 to 120 min and

covered different topics for the students and the facilitators. The students were asked to talk about: 1) their group and their collaboration, 2) perceived learning outcome and 3) the intervention. The facilitators were asked about their observations of the groups' collaboration and their own experiences with facilitating them. The focus group approach was selected to stimulate discussion and to include perspectives from different student groups. Sharing views and experiences and asking each other questions can activate forgotten nuances and lead to understandings being re-evaluated and reconsidered (Catterall & Maclaran, 1997). The interviews were transcribed, anonymized, and analyzed using a conventional qualitative content analysis (Hsieh & Shannon, 2005). This type of analysis identifies themes directly from the text data without preconceived theoretical perspectives being imposed.

A second source was the written process reports (in total 33 reports), which were also analyzed using content analysis (Hsieh & Shannon, 2005). The analysis identified the situations the groups had chosen to discuss, tools used for group processing, reflections on learning outcomes or insights, and the intervention. In this paper, we build on the analysis with respect to: 1) what was written about the intervention, and 2) what was written about the students' learning outcomes and insights into collaboration.

2.4. Ethical considerations

The study follows the ethical guidelines required by the Norwegian National Research Ethics Committees (NESH 2014), and ethical approval was given by the Norwegian Centre for Research Data (NSD). After being informed about the study (orally and in writing), the participants gave their consent to participate. They were informed that they were free to withdraw from the study at any time or for any reason.

3. Findings

Table 2 shows the descriptive statistics for the two cohorts. The

findings show that the scores for cohort 1 (that was involved in the intervention) were significantly higher than cohort 2 (that was not involved in the intervention) for all variables. The effect sizes are from intermediate to large using Cohen's interpretation of magnitudes (Lenhard & Lenhard, 2016), and particularly high for overall learning outcome and insight. Following the aim of this study, to explore *to what extent and how team-skills training and real-time facilitation stimulate group processing and students' ability to articulate collaboration*, the two main topics *learning outcome* and *group processing* will now be presented in turn. A primary focus will be on the students' experiences and how the qualitative data supported and deepened the quantitative data.

3.1. Perceived learning outcome

The two scales *overall learning outcome* and *insight* in the questionnaire both relate to the students' perceived learning outcome. As a third topic, we also asked about giving and receiving feedback. While the insight and feedback each showed strong internal consistency, the findings from the qualitative data showed that these were closely connected for the students. In the interviews and exam reports, the students explained how being "forced" to give feedback on each other's behavior had increased their insight. To explore this finding further, we returned to the questionnaire to calculate the Pearson correlation coefficient. Pearson's r between insight and feedback was 0.739 with a p-value of .000. The finding thus indicates that giving and receiving feedback strongly contributed to the students' perceived learning outcome, in particular learning relating to increased insight into their own behavioral patterns and those of others.

One of the feedback situations for cohort 1 was a "2 + 1 feedback exercise" towards the end of the semester. In this exercise, each group member gives three feedback comments to all the other group members: two positive and one on something the recipient can work on improving. They were also challenged to provide the same 2 + 1 feedback to themselves (self-insight). All but one of the students who participated in the interviews emphasized that the feedback exercise was very helpful. This was also mentioned in many of the exam reports. As one student said:

I received feedback that I can seem a bit scary as I'm pretty straightforward. I say what I mean, I have my goals that I wish to achieve and may seem a bit scary to others. I understand that, but it's not something I've thought about before someone actually told me, and it was very helpful to hear because you don't think that you could be scary to someone else. (1A-1).

Another student said:

I was very fascinated by how much my attitudes and actions might affect the whole group. When I was stressed, I kind of had hoped that it was not so visible … that I still managed to work in a proper way …. But when many reacted to it … It tells me that I have to be more open about my own thoughts and how I'm actually doing. Then others don't have to be confused or unsure.

So for me it's [the most important insight] about being open, to talk about how I feel. (1A-4)

Some participants emphasized in the interviews that giving and receiving feedback was uncomfortable, but that they learned a lot from it on an individual and on a group level.

While the findings from the questionnaire showed significant differences between cohort 1 as a whole and cohort 2, this was not found between 1A (with real-time facilitation) and 1B (without real-time facilitation). The focus groups and the reports, however, revealed some differences in *how* the students talked about the insights they had gained through the group task. The findings indicate that cohort 1A students who were monitored during their collaboration seemed to have become more aware of their own behavior patterns than cohort 1B students. This finding became apparent in the analysis of the interviews, which showed that cohort 1A students used more precise language when discussing collaboration than cohort 1B. They talked about their learning in explicit terms, pointing out specific learning from receiving feedback from peers. Cohort 1A participants provided concrete examples of how they had become aware of certain aspects of collaboration and group dynamics, which starkly contrasted with the focus group interview for cohort 1B. We could find no similar examples from cohort 1B; they described their learning in more general terms, such as "I've learned a lot". For example, a student from the focus group for cohort 1A stated (referring to a situation during real-time facilitation):

After we were presented with the sociogram, we became more aware of who we looked at when we talked. We then tried to look at everyone to make them feel included. This was important for the group dynamics …. It was also important to ensure everyone's contribution. One consequence of this [awareness] was that the group became more group-oriented, rather than individual-oriented, which was important for the group to function well. (IA-7)

Another example (also from the focus group) was how the explicit focus on collaboration allowed the students to try different roles:

For me, it was very good that we assigned those roles. … because I'm very uncomfortable in a leadership role, so to try that leadership role. It was very good to really challenge myself …. just trying having a bit of extra responsibility. Be the one who actually said 'you know what, now we need to focus, we have to move on'. It was actually quite rewarding, at least for me. (1A-4)

3.2. Group processing

The assumption underpinning this study was that thematizing and reflecting upon the group's collaboration would enhance the students' insights about themselves and others and support the development of a language about collaboration. The quantitative data showed that cohort 1 students scored higher than cohort 2 on the questions related to group processing, meaning that they reported having reflected on their collaboration to a larger extent during the semester. In the analysis of the interviews and the exams report, we sought to understand *why* and *how* the intervention might have had this effect. In addition to the feedback exercise described above, we identified three structures that seemed to enable the students to develop collaborative skills. These structures were: 1) the presence of a facilitator during collaborative work, 2)

Table 2
Means, standard deviations (SD), p-values and Cohen's d values.

	Cohort 1 Mean (SD)	Cohort 2 Mean (SD)	p	Effect size d
Overall learning outcome	5.13 (.99)	4.19 (1.06)	.000	.92
Insight	5.19 (1.02)	4.33 (1.16)	.000	.78
Feedback	4.87 (1.09)	4.25 (1.07)	.001	.57
Group processing	4.92 (1.28)	4.34 (1.27)	.006	.46

writing a collaboration agreement, and 3) using the team practices 'check-in' and 'check-out' in the beginning and at the end of group meetings.

3.2.1. The presence of a facilitator during collaborative work

Cohort 1A students mentioned, in the interview and in the reports, how and when they talked about group dynamics. They mainly discussed group dynamics and the roles they had taken when the facilitators were present. The students reported facilitator presence as being positive and necessary for them to talk about and develop their collaboration. As one of the groups wrote in their report:

> The facilitators made us aware of the group dynamic and how different members affect a group. As a new and complex group that had to collaborate for a long time, we were conscious of our roles and how we communicated … Along the way, the facilitators came to the group and shared their observations. We became aware of the interaction in the group and how the interaction worked. (1A-3)

The interviews with facilitators provided examples of how their interventions had resulted in group reflection and led to changed behavior. Some examples were the same as those brought up by the students. One example was from a group in which group members, and one member in particular, kept leaving the room during the sessions for no apparent (good) reason. None of the group members said anything about this. The facilitator, however, said he could sense some annoyance, his assumption being that nobody dared address the problem. When he shared his observation with the group, there was first resistance to discussing it. This was, however, followed by a conversation on participation and contribution in the group, which led to a change in behavior in group member presence during work sessions.

The students of cohort 1B said that they did not really talk about group dynamics or their collaboration explicitly outside of the seminars. One of the participants said that her group wished they had the opportunity cohort 1A groups had to be observed. These focus group participants were more interested in discussing the quality of their supervisors than cohort 1A focus group participants. The discussion was initiated with a conversation about what kind of support the groups needed when problems occurred within their group. The discussion then led to a dialogue on supervisors. The experiences of the two groups were quite different, as illustrated by the following quotes:

> I think there is a link between having a good supervisor and good group collaboration. Because when you encounter a moment of frustration and you can't get good help from the supervisor, then this might turn into frustration that influences the group as a whole, which might result in bad group dynamic. But we were fortunate to have a fantastic supervisor who helped us all the time, and I think it may have helped our collaboration (group 1B-2).

> No, we didn't have a great supervisor. We didn't get an answer for three weeks, even though we asked. …. And at the meeting with the supervisor, the students who caused difficulties didn't collaborate at all; they talked about completely different things. Our supervisor realized that … he understood us very well, but he didn't do anything then either (group 1B-3).

These two examples say something about the students' expectations of their supervisors. They expected the supervisor to help them if they "got into trouble". The second quoted group had

struggled throughout the project due to two "free-riders". This was a significant problem for them throughout the semester, and they ultimately completed the project without much being contributed from these two problematic students and with no, or little, external support. The topic of supervisors was not initiated at all in the interview with cohort 1A participants. Instead, they talked about the facilitators and expressed similar facilitator expectations as cohort 1B students had of their supervisors.

There were, however, also some challenges related to the presence of the facilitator. One challenge was *time*. The facilitator and the group need to get to know each other, at least to some extent, to establish a good relationship. This requires time. One of the groups in cohort 1A mentioned that they did not feel that the period in which they were observed represented their collaboration well as a whole. Other participants said that if the facilitators had more time with the groups, then they could have given better or more feedback. The facilitators were present during three group sessions (each lasting 3 h). The facilitators confirmed that it was difficult to build a relationship in this limited time, particularly with some of the groups that expressed more resistance. Limited time might have also made it more difficult for the students to move from *reflection* to *action*. A number of participants talked about their discussions during the facilitated group work sessions having identified needs for change, but that they had been unable to follow up on this.

The second challenge relates to students finding being facilitated (i.e. observed and sometimes interrupted) challenging and foreign. Some participants said it was "a bit strange" and uncomfortable at the beginning, but became more natural and useful. Others expressed more resistance. Examples of descriptions of their experience of being observed include: "We were tuned in on a good work session and there is this guy in the corner while you sit and write", "I felt it was a bit like a know-it-all who sat there and evaluated us", "it was really frustrating with a facilitator … or not frustrating, but strange", "it feels like an assessment, even if it's not, really". Another example is:

> My group was generally very negative to the facilitator's role, the rest of my group. They saw no benefit in it, I can understand it … it was not representative, the observation time was just a very short part of the whole time we worked together, it is not enough to base a discussion on." (Group 1A-5)

The facilitators reported that they also felt the resistance expressed by the students. From their point of view, however, some resistance is a natural part of the process. They had planned a gradual process, first focusing on establishing a relationship with the groups, then "pushing" more in the second and third meeting. The rationale behind this plan was that groups need time to get used to the concept of facilitation. The facilitators discussed the importance of talking about their role and routinely repeating this information for the students. It is important that facilitators emphasize that they are primarily there to share their observations with the group and help the group *reflect* and solve their issues *themselves*, not evaluate the process or provide a solution. However, this was somewhat difficult for the students to understand or accept in the limited time they spent together. This is illustrated by the following excerpt from the discussion in the 1A focus group:

> IA-8: It's ok to sit and work, but they [the facilitators] could have played, let us say, an active role, they might have commented on things along the way, interrupted or given us exercises. Didn't have to take that long … No I just struggled to understand their role …

1A-4 We asked. We asked our facilitator straight out: have you noticed something today, is there something we should take with us onwards? After that meeting and at last one she was very honest, this is what I have seen today. Some were questioners in the group and others were responders; it made us aware of who we were in the group. But yes, we just asked directly, and she was very clear in the last facilitator meeting about why she had done it the way she had. It somehow explained why they had been quiet at the beginning.

IA-5 I did exactly the same thing, I asked: have you observed something, is there something we can do? And then we got questions back: What do you think? What does the group think? Like we received nothing. I tried myself quite a few times, but it was often returned as 'yes what do you think', so we had to then start discussing.

IA-7: I understand in a way what they want, they want us to discuss group collaboration, but it was like … it feels a bit like: just please say something!

IA-4: But we did not ask until after our conversation had died out, when we had in a way finished talking. So in a way we asked and discussed at the same time, because they wouldn't say anything to us before we had discussed ….

3.2.2. Writing a collaboration agreement

Writing a collaboration agreement, which was introduced and conducted at one of the seminars, was identified by the students of both cohort 1A and 1B as particularly useful. In the focus groups as well as in the exam reports, the students reported that writing this agreement helped establish a common understanding of commitment to and ambitions for the project. It also allowed them to talk about their collaboration right at the start. The students used this agreement differently. The most important aspect for some groups was to write it, and they did not look at it again. Others, however, used it more actively. The facilitators mentioned two occasions when they encouraged groups to revisit the agreement. This turned out, in both cases, to be very helpful. In one, the facilitator said that "at the end of the group work session, the collaboration agreement that they [the students] found useless when they had to write it, saved them".

3.2.3. Check-in and check-out

"Check-in" and "check-out" were introduced to the students in the team-skills training seminars, as tools for opening and closing a work session. Check-in is an intentional group or team practice for opening a meeting or session. One at a time, and without any comment from the others, each participant shares what they bring to the meeting. The intention is to remove potential personal distractions and make it easier to focus on the work ahead. A check-in is about the status of the mind, not of the project. Check-out takes place right before the meeting ends and is normally used to gather information about the meeting itself: how valuable it was, comments about the meeting structure and contents, and any specific feedback.

Check-in and check-out were identified as useful practices for supporting and understanding collaboration in all three focus group interviews and in the reports. Many of the groups reported using check-in or check-out, or both, regularly or at least at the beginning of the project. The student groups mentioned that they found check-in to be useful because it provided an opportunity to reconcile expectations, or to talk about how they felt that day and about things that could potentially become distractions during the

meeting. There are also examples in the reports of groups that had not used or had stopped using check-in, but wished they had continued to use it, as they thought it would have helped them work better together as a group. One of the participants also mentioned he wanted to use check-in as a teacher: "Perhaps introducing check-in might be helpful for them to know how the group [members] are doing, that they need to make plans. The goal must be that they manage to solve problems themselves. (1A-6)."

He also emphasizes in this quote that it is important that students learn how to tackle problems themselves and are less dependent on the teacher.

One group described how they used check-out to give each other feedback. In this group, which was from cohort 1A, some members were often unsure how their actions or behavior had been perceived by others in the group. This is what one of the students in this group wrote in the report:

> I consider myself a committed team member, but I have been concerned that I can be a bit abrupt and too straightforward in discussions. Feedback from the group on this, on the other hand, has been that they perceive that I am clear and that I get things done, and so it has been lovely to have a group where there is room for the differences between us, and who have also been good at providing constructive feedback along the way. This has made me feel safer in the meeting with the other group members.(1A-4).

4. Discussion

The aim of the intervention in this study was to develop students' ability to articulate and learn from collaboration. The overall findings show that the intervention seemed to have had a good effect on the students' insight into their own behavior patterns in a group and on stimulating group processing. By exploring the students' experiences, we also identified some structures that can explain *how* and *why* the intervention might have had this effect. In addition to the structures identified directly from the data, the overall task design might also have been an enabling structure. We paid particular attention to the main objective when designing the intervention: students should learn how to collaborate and support should be introduced to structure group interaction (cf. De Hei et al., 2016; Webb, 2009). Talking about and discussing group dynamics can be uncomfortable. Many researchers have therefore emphasized the importance of explicitly training students in giving and receiving feedback (e.g. De Hei et al., 2015; Fransen et al., 2011; Näykki et al., 2017; Webb, 2009). Lockhorst et al. (2010) emphasized the importance of a safe environment when training collaborative skills. The students in this study were provided with the tools needed to support group functioning and to stimulate reflection on collaboration through team-skills training and facilitated group work sessions. The students were encouraged to use this opportunity to learn more about themselves in a group and to experiment and challenge previous patterns or habits. The task design therefore created opportunities for the students to develop their collaboration skills in a safe environment. The quote from the student who challenged herself to take a leadership role shows that the learning environment enabled her to do this.

The questionnaire revealed significant differences between the students who were part of the intervention and those who were not. Our findings are thus in line with other research on the impact of team-skills training on students' learning outcome (e.g. Kutnick & Berdondini, 2009; Prichard et al., 2006). It was not, however, conclusive on differences between cohort 1A and 1B, nor therefore on the differences between the *combination* of team-skills training

and real-time facilitation and providing just team-skills training. The intervention stimulated group processing in both 1A and 1B. The findings, however, indicate that the effect was greater for cohort 1A who was subject to real-time facilitation. The presence of a facilitator stimulated group processing and therefore gave the students more opportunities to talk about collaboration and to think about their assumptions and behavior (cf. Kaner, 2007). According to the participants, the students only talked about collaboration when prompted by the facilitator or. For cohort 1B, this opportunity was only in the seminars. This supports the findings of Fransen et al.'s (2011) study that students are pragmatic and are primarily focused on the task. The analysis also revealed that the students who were facilitated real-time were more specific about what they had learned about their own behavior patterns than the students who only had team-skills training. Cohort 1B participants, even though they were asked to be specific, only described learning in general terms. Cohort 1A was, in other words, better at articulating what they learned, in particular what they had learned from receiving feedback.

The students who were facilitated real-time (1A) also seemed to be less dependent on the supervisor. Cohort 1B talked quite a bit about their supervisors. This topic was, however, absent in the 1A interview. The two examples from cohort 1B with their very different experiences of supervisors indicate that their conclusion seemed to be that student groups are dependent on external help if they get stuck. The group with "free-riders", for example, learned that some people are just impossible to work with, and thus ended up with a negative learning experience (cf. Häkkinen et al., 2017). A facilitator might have helped the group address the problem, learn more about why it happened, and perhaps even do something about it (cf. Kaner, 2007), as in the example from 1A in which students kept leaving during the session. Free-riders or social loafing are reported as being the primary challenge in student groups (Borrego et al., 2013; Hammar Chiriac, 2014). There is, however, little research on how groups can learn to address this challenge when it arises and what they can learn from it. One could ask whether at least some students in who were facilitated real-time became more aware of their own responsibility (and capability) to solve their own problems, therefore becoming less dependent on other forms of external help. This suggestion is supported by the example of the student who wanted to introduce his future students to check-ins; he emphasized that the goal must be that students learn how to solve problems themselves. This goal is an important aim of facilitation: to enable groups to work well together and become self-facilitative (Kaner, 2007).

The presence of facilitators was important. It was, however, also challenging for most of the groups, as illustrated by the excerpt from the cohort 1A focus group. The students struggled to understand the role of the facilitators and were frustrated when facilitators returned their questions instead of answering them or providing solutions. One reason for this frustration might be that the facilitators had not been able to explain their role and the intention behind their practice. Another reason could be that the students were unfamiliar with the practice of primarily asking open-ended questions, both from schools and from university. The students had previous experience with group work. However, many university students are the product of a traditional school culture (i.e. a traditional teacher-led approach), even when working in groups (Mäkitalo-Siegl et al., 2011).

Much has been written about the teacher's role in facilitating collaboration (e.g. Kreijns et al., 2003; Lockhorst et al., 2010; Webb, 2009). However, the facilitators in this study were not teachers but students who had been trained in facilitation (in particular "observing and mirroring"). This is particularly interesting in the context of higher education. The teacher to student ratio is often much lower in higher education than in a school setting, and real-time facilitation is therefore seen as unrealistic. The findings of this paper raise the question of whether group facilitation needs to be carried out by a teacher or whether "observing and mirroring" is the important aspect. Kaner (2007) defines a facilitator as a content-neutral party. This opens up the possibility of using students as resources and providing opportunities for students to be trained in observation.

4.1. Limitations and implications for research

This study has certain limitations. First, although we had a control group, we did not have pre- and post-tests; the results rely on the students' perceived learning outcomes at the end. Therefore, we cannot compare *development* through the semester. A pre-test could measure how students assess particular skills or test students' ability to articulate collaboration in the beginning of a course or a task. This would allow for more robust conclusions about how the particular course or intervention contributes to the students' learning. Furthermore, self-reporting assumes that respondents are able to answer accurately (Groves et al., 2011). Accurate responses are more likely if the questions are specific. Second, we only collected qualitative data from cohort 1, focusing on the intervention. Exploring the experiences of students who did not have the same support as cohort 1, could have led to deeper understanding of how students talk about and learn from their experiences in collaborative work.

Our assumption when designing the intervention was that explicitly focusing on reflection throughout the whole semester would result in learning that could be transferred to future settings. This is still an assumption and open question, as we followed students through one semester. Future research with longitudinal design is needed to explore how students' insights and skills play out in new group settings or when applying collaborative learning approaches in the classroom. There is also a need for research that looks further into the potential affordances of real-time facilitation, and the effect group processing might have on students' learning of collaboration.

5. Conclusion

This paper has sought to advance our understanding of facilitating student teachers' learning of collaboration as an educational outcome in its own right. In this study, we investigated the impact of stimulating group processing and student reflection on the group's functioning instead of evaluating product quality or group effectiveness. The study supports research that emphasizes the importance of facilitating collaborative work in higher education (e.g. De Hei et al., 2015; Pellegrino & Weiss, 2017), and provides some important practical implications.

These implications first include the need for task designs that *explicitly* focus on learning to collaborate, and that create a safe learning environment for experimenting with different patterns of interaction. The study has identified specific structures or tools that can be included in such a design. Second, the study implies the need to stimulate group processing by 'forcing' students to talk about their collaboration while they are working. The study particularly highlights the potential affordance of real-time facilitation and also of using students as teaching resources.

Collaboration is a key competence in most workplaces, including schools. A focus on collaboration in teacher education should contribute to students increasing their insight and collaboration skills whilst in training, in their professional development as teachers, and ultimately for the next generation of learners. Triggering change in schools requires that student teachers learn how to adapt to new learning cultures and to new teacher roles

whilst being students (Häkkinen et al., 2017). In this paper we have argued the importance of an explicit emphasis on collaboration skills and group dynamics in achieving multi-fold long term effects.

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