Working under Best Conditions: The Power of Collaboration in the Satisfaction with

Students' Learning Experiences

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Abstract

Collaborative learning (CL) within educational environments becomes increasingly popular, with research showing its success regarding knowledge retention, positive affect, motivation, and academic performance. However, less clarity emerges regarding specific mechanisms underlying students' satisfaction with collaborative learning (SLE), as well as the optimal learning context for CL success. Therefore, the current study investigates whether social cohesion moderates the relationship between CL and SLE. Based on social learning theories, it is proposed that higher degrees of social cohesiveness should lead to students' higher SLE, because of elements of trust building and interpersonal support. Additionally, due to research indicating that the learning environment directly impacts the group's atmosphere and sense of belongingness, we investigate whether the learning context affects the group's social cohesiveness directly. A correlational study ($N = 126$) was conducted using an online questionnaire via Qualtrics. Subsequently, multiple regression, as well as one-way ANOVA was employed to analyze data of two cohorts with an online and hybrid CL method. Results showed insufficient evidence of a moderating role of social cohesion, and no significant difference of social cohesion in the online and hybrid CL context. Practical interventions, focused on the benefits of increasing CL in education, are discussed.

Keywords: collaboration, satisfaction, team and social learning, social cohesion, hybrid education

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On the Importance of Collaboration

Education is an integral and major part of everyone's life. As such, it contributes to cognitive, personal, interpersonal, and emotional development (Gratton, 2019; Tseng & Yeh, 2013). Within contemporary global society, education is constantly changing from frontal delivery of predefined learning content to more social and collaborative learning approaches, leading to the empowerment of students (Gratton, 2019). In current research on pedagogy and education, Collaborative Learning (CL) emerged as an effective means of knowledge creation and retention (Miyake & Kirschner, 2014). Throughout this paper, CL is defined as students working together to maximize both individual and group learning using small groups under instructor's guidance (Johnson & Johnson, 2014). CL is assumed to be increasingly implemented in modern education because of the various benefits of small group learning (Sawyer & Obeid, 2017). Nowadays, CL has steadily progressed to being one of the dominant instructional practices throughout the world, with social scientists emphasizing the essential role of peer interaction and relationship building in socialization and learning (Johnson & Johnson, 2009).

Importantly, CL does not automatically lead to satisfactory learning experiences, as studies have found mixed results regarding its best implementation and highest effectiveness (Tseng & Yeh, 2013; Jeong et al., 2019). This is exemplified by the global pandemic with its unique challenges of a rapid transition to online education, as well as by emerging educational practices such as blended and computer assisted CL. Furthermore, interpersonal relationships, trust building, as well as the resulting group cohesiveness have been proposed to directly affect student's learning experience and satisfaction with CL (Croy & Eva, 2018). However,

there has been little research directly comparing the effect of different modes of CL on the developing social cohesiveness.

As such, the present study examines if there is a relationship between students collaborating within a semester-long bachelor thesis group project and their subsequent learning satisfaction, and whether this relationship changes under varying levels of social cohesiveness. Furthermore, as the global pandemic causes adaptations in university education, this study provides the unique opportunity to investigate how the two learning environments, online and hybrid, will directly impact the moderator social cohesion. Conclusively, this study provides the opportunity to inform optimal conditions of future educational practices, leading to a better learning experience. In turn, a more positive learning experience might enhance the psychological health and performance of students within CL groups (Wohlsifer et al., 2021).

Cooperative Learning Theory and the Concept of Collaborative Learning

The rationale underlying CL is based on Cooperative Learning Theory (CLT) with five essential elements, namely positive interdependence, promotive interaction, individual accountability, application of social skills, and group processing (Johnson & Johnson, 1998; Yi & LuXi, 2012). If successfully implemented, these components enhance student's motivation and interest in learning. Originating out of Social Interdependence Theory (SIT; Johnson & Johnson, 2014), *positive interdependence* among group members posits that individual group members engage in mutually beneficial actions to fulfill common group goals. Consequently, individuals' actions affect the group as a whole, inducing dynamic changes. The group's interdependence produces *promotive interaction* during which individual group members support and motivate each other to succeed. Provision of instrumental and social support leads to a facilitation of each other's work, shows to be beneficial for involving everyone in the learning process, promotes feelings of self-efficacy, and leads to more diverse results through the input of each unique group member (Johnson &

Johnson, 2014). In the CL environment, the personal responsibility that everyone possesses to positively contribute to the group product is termed *individual accountability*. This element has been shown to increase commitment, perseverance, self-esteem, as well as decreasing social loafing to the expense of the group's learning success (Altebarmakian, 2021). The fourth element in CLT subsides in students to be taught interpersonal and small-group skills to coordinate and achieve mutual goals. This process of building more positive relationships through the *application of social skills* potentially leads to trust building, effective communication, mutual acceptance, and support, as well as constructive conflict resolution (Johnson & Johnson, 2009). Ultimately, *group processing* occurs as a reflection of group members on which collaborative actions were helpful, and clarification of group's goals and their importance, which result in increasing collective efficacy within the CL environment.

According to Social Learning Theory (SLT; Bandura, 1963), humans as social animals acquire many new skills and information through observation of and social interaction with relevant others (McLeod, 2016). Conclusively, CL provides a context for learning to occur, as peers can provide positive role models for each other and engage in collective cognition as a group process, leading to increased knowledge retention and consensus. Through these mechanisms, learning is shaped by the learning context of collaboration and the quality of group interaction (Hill et al., 2009). Relatedly, principles of social constructivism entail that knowledge is constructed, shaped, regulated, and meaningful within a social context (Schoor et al., 2015). Exemplified in CL, we need to cooperate with one another to create knowledge, with the social interaction and discussion promoting deeper individual understanding and reasoning (Sawyer & Obeid, 2017).

According to Dewiyanti et al. (2004), collaboration facilitates participation of more passive and introverted group members, promotes a higher sense of presence and engagement, and increases individual contributions. Through constructive discussions, CL potentially

reduces prejudice, and enhances perspective-taking and problem-solving skills (Johnson &
Johnson, 2014). Moreover, CL provides students with an opportunity to shape their learning
progress more actively, as well as teaching communicative and group skills, such as conflict-
management and organizational skills (Altebarmakian, 2021). These skills can arguably offer
an advantage to students when entering the global labor market because effective teamwork
can be regarded as a competitive advantage. In connection with SLT, CL fosters more
autonomous learning abilities, a shift from instructor dependence to positive interdependence
with the CL group, as well as openness, respect, and social responsibility, contributing to a
positive social identity formation (Gratton, 2019). Conclusively, it can be argued that the
benefits of CL extend far beyond proximal outcomes of immediate achievement, as they
contribute to the formation of mature and responsible individuals and set the stage for
pleasure and motivation of lifelong learning (Gratton, 2019).

Collaborative Learning and Satisfaction with the Learning Experience

Satisfaction with the learning experience (SLE) is an important affective outcome of
CL, comprising an evaluation of the quality and value of learning, and the degree of learning
motivation (So & Brush, 2008). The existence of a positive association between perceived
collaboration and SLE has been repeatedly shown in educational environments (So & Brush,
2008). Sawyer and Obeid (2017) suggest that feelings of interpersonal connection, closeness,
trust, and interdependence present in higher collaboration may increase students' motivation
and consequently their SLE. As such, CL has the potential to lead to a more positive learning
attitude which can foster future engagement and shape subsequent cooperative efforts
(Sawyer & Obeid, 2017).

The importance of enjoyment in and satisfaction with CL manifests itself in supportive
interpersonal relationships, and enhanced transfer of CL to novel tasks and contexts,
beneficial for future teamwork (Sawyer & Obeid, 2017). Consequently, positive outcomes of

an increased SLE, such as openness and motivation, can set the stage for a positive feedback loop. That is, positive experiences of past productive CL, fostering social skills and knowledge, can increase both the commitment and investment expanded to engage in future successful CL (Gratton, 2019).

The Online and Offline Context of Collaborative Learning

Learning has been shown to be context dependent, as optimal conditions can change over time and can be adapted to the individual (Jeong et al., 2019). With advances in technology, distance learning modes increase in popularity and are widely discussed regarding their optimal use and effectiveness, especially in contrast to traditional on-campus instructions (Jeong et al., 2019). The concept of learning is dynamic and constantly changing, with the rise in new technologies enabling both customized learning but also an increase in collaborative and team learning (Miyake & Kirschner, 2014). Even though most education is traditionally provided on-campus, the complementary or exclusive use of online education has gained new attention through the global pandemics' restrictions of physical education (Wohlsifer et al., 2021). Argumentatively, with the immediate switch to distance education during the corona pandemic, productive CL has become a valuable tool to decrease isolation and feelings of loneliness (Jaervela & Rose, 2020). Furthermore, with the increase in global interconnectedness and interdependence, online education provides the advantages of immediate accessibility, lack of geographic limitations, diversity of perspectives and resources, simultaneous interaction with multiple individuals, and increased speed of transmission (Johnson & Johnson, 2014).

Moreover, in the online learning environment, through emerging technologies like computer supported CL (CSCL), a higher sense of engagement and active exchange among students and instructors can be achieved (Dewiyanti et al., 2004). Additionally, Jeong et al. (2019) provide evidence for the CSCL environment exerting a positive influence on student's

learning process and knowledge gains, but also on motivation, attitudes toward online CL, and self-efficacy beliefs.

Regarding the current study, online education is defined as delivery of knowledge, group communication, and instructor interaction solely in the online context via communication platforms, with the primary assumption that students and instructor do not meet physically. This is contrasted with offline education, defined as small group work with weekly in-person meetings, consisting of both frontal teaching from the instructor and instructor guided discussions among the collaborating students. Additionally, on account of changing circumstances during the studies conduction and as optional weekly group meetings, both offline and online, with and without the supervisor were possible, in the present study, the offline cohort can be more accurately described as a hybrid cohort.

With respect to CL, face-to-face interaction has been shown to be more effective and productive through the investment of energy, commitment, direct engagement, and increased focus (Johnson & Johnson, 2014). As such, online CL will most likely not substitute for on-campus CL, because of elements of touch and nonverbal behavior which can contribute in unique ways to building long-term interpersonal relationships of trust, support, and respect, hypothesized to be integral for student's SLE (Johnson & Johnson, 2014). It can be assumed then, that the success of, and satisfaction with, online CL depends on the given social skills and dynamics, potentially building safety and trust in a more anonymous learning environment. Conclusively, we expect that whether the relation between CL and SLE holds for the online setting to the same extent as for the hybrid setting may be dependent on the social group dynamics.

The Role of Social Group Cohesion

Humans share the fundamental need to belong, with the goal of developing stable and close interpersonal relationships (Chung et al., 2020). To fulfill such belongingness needs,

individuals need to feel accepted by their ingroup including regular positive interactions, essential for psychological health and productivity (Chung et al., 2020). Regardless of the CL environment, students require a sense of group belonging and trust, created through emotional and instrumental support, as well as positive interdependence among group members (So & Brush, 2008). Particularly, research points to the importance of positive and beneficial interpersonal relationships as one ingredient facilitating the success of CL (Johnson & Johnson, 2014). Throughout this paper, social cohesion is defined as interpersonal liking of the group members, as well as feeling connected with and supported by the other group members (Miyake & Kirschner, 2014). Within the CL context, cohesion is evident in the development of close bonds, self-identification with the group and its goals, and membership commitment (Altebarmakian, 2021). It has been proposed that the degree of social group cohesion within CL groups determines its social structure and dynamics, with cohesion fostering meaningful joint knowledge creation (Altebarmakian & Alterman, 2019).

Social cohesion has been repeatedly identified as an essential element of productive CL across tasks and learning contexts (Altebarmakian, 2021). That is, through active exchange of ideas and opinions, as well as interpersonal connectedness, social cohesion fosters perseverance, motivation, and commitment to common success and interpersonal well-being, leading to both CL success and SLE (Altebarmakian, 2021). Potentially, if social cohesion is stronger, CL can provide a safe space for group members to express themselves freely and foster personal bonds both with the instructor and among students (Yi & LuXi, 2012). The social cohesiveness of a group has been found to be associated with helping behavior, overall health, creativity, and academic performance (Chung et al., 2020). In particular, the element of positive interdependence in CL may be facilitated by social cohesion through affective commitment of individual group members to mutual support and disclosure (Johnson & Johnson, 2009). Simultaneously, group cohesion has been shown to

amplify the effect of positive interdependence among group members (Galyon et al., 2016) and facilitate the identification with the CL team and its values (Chung et al., 2020), leading to academic satisfaction and success. Consequently, CL, in the context of high group cohesion, trust, and respect, strengthens student's SLE as well as fostering future CL motivation (Gratton, 2019).

Importantly, CL can hamper the development of positive group dynamics if it involves a lack of shared commitment, trust, and communication (Tseng & Yeh, 2013). Essentially, the exchange of individual work, and regular self-initiated interaction in CL might be facilitated by the social cohesiveness of the group. As a result, students acquire higher self-efficacy beliefs, self-esteem, and intrinsic motivation, potentially promoting the SLE (Galyon et al., 2016; Leon-del-Barco, 2018). Thus, it can be hypothesized that the feeling of interconnectedness evident in social group cohesion might be an important moderator in the relationship between CL and SLE.

The Effect of Social Cohesion in the Offline and Online Collaborative Learning Context

The interpersonal space of learning, inclusivity, and interactivity of group members jointly influence the development of social cohesion (Altebarmakian & Alterman, 2019). Despite equal levels of class participation, self-reported social cohesion has been shown to differ significantly depending on the online or on-campus course modality, with mixed and inconsistent results regarding its impact (Wohlsifer et al., 2021; Gratton, 2019). On the one hand, within CSCL environments, the presence of group cohesion and trust has been shown to allow for smooth teamwork, commitment, as well as decreased turnover and absenteeism (Dewiyanti et al., 2004). Further, in an online CL class, trust and social cohesion facilitated weekly interactions and support giving, leading to higher learning success, retention, and satisfaction (Wang, 2007). On the other hand, online CL entails potential disadvantages such as the lack of face-to-face interaction, non-verbal behavior cues, and physical proximity, all of

which can interfere with the developing cohesion (Galyon et al., 2016). As such, the online setting poses increased difficulties to connect interpersonally through obstacles in communication, coordination, and collaboration, which decrease motivation and proactive behavior (Altebarmakian & Alterman, 2019). This might imply that CL on-campus shows a more positive impact on the SLE and subsequent performance than online CL, through more optimal conditions for establishing the group's social cohesiveness.

The Present Study

The present study consists of an online questionnaire survey of bachelor students, conducting their bachelor thesis research in small groups within two different learning environments, namely online and hybrid. The term hybrid will be used interchangeably to offline CL, due to the combination of both on-campus and online teaching elements. Concretely, the relationship between CL and SLE under varying levels of social cohesiveness will be examined. Especially in unpredictable times of a global pandemic affecting educational practices, the present study provides the unique opportunity to examine the direct effect of the two modes of CL on the developing social cohesiveness. The moderation effect of social cohesion is expected to hold in both learning environments. However, indicated by prior research, the moderating effect could be stronger in the hybrid CL context.

In line with this theorizing, the following three related hypotheses can be posed, to be subsequently empirically tested (see Figure 1):

Hypothesis 1. CL will be (significantly) positively related to SLE.

Hypothesis 2. The strength of the relationship between CL and SLE will (partly) depend on the level of social group cohesion, with higher social cohesion strengthening the relationship between CL and SLE.

Hypothesis 3. The CL context, hybrid and online, will have a direct effect on the moderator of social cohesion.

Figure 1

Hypothesized Moderation of Social Group Cohesion in the Offline and Online CL Context
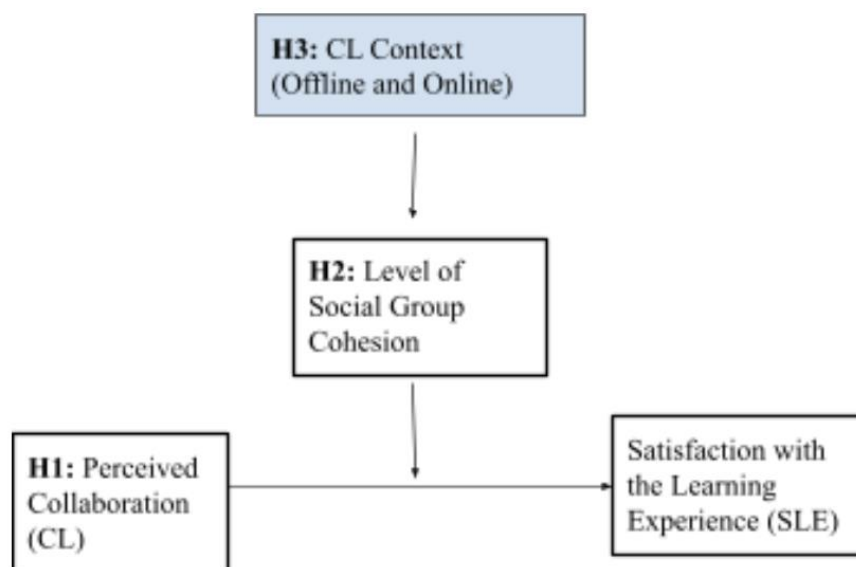
Method

Participants

Two convenience samples of third-year students within the Psychology department at the Rijksuniversiteit of Groningen (RUG), who were registered for the bachelor thesis project, participated in the study. Each participant was individually recruited via a mailing list and through researcher's social networks. The majority of participants were of Dutch and German nationality. The participants were recruited from each bachelor thesis group consisting of an average of six students with either Dutch or English as course language. Of the 521 students who were invited, 169 participated in the study. A total of 126 students (97 females, 28 males, and one other) completed the questionnaire and their data was included in the analysis, resulting in an attrition rate of 25.4 percent. Consequently, from the initial sample, 43 participants were removed. Exclusion criteria comprised unusually short participation time in combination with response sets, being enrolled in an individual project, failed control questions, and indications of dishonest responding. The mean age of the final sample ($N = 126$) ranged from 20 to 41 years ($M = 22.9$, $SD = 3.3$).

Online Cohort

The responses of the online cohort consisted of data, collected in the second semester of 2020/2021 by the collaborating bachelor thesis students. A total of 323 potential participants from the online cohort were invited per email to participate of which 98 students filled out the questionnaire. The final sample, fulfilling all eligibility criteria, consisted of 74 third year graduate students (55 females, 18 males, and one other), constituting a response rate of 22.9 percent. Although there was no exact data collected within this cohort regarding the frequency of meetings, it was assumed that the groups met an average of once per week with their supervisor throughout the thesis project. Their average group size consisted of six students and their ages ranged from 20 to 41 years ($M = 23.4$, $SD = 4$).

Hybrid Cohort

The data of the hybrid cohort was collected by the bachelor thesis group of the first semester of 2021/2022, collaborating in the present study. A total of 198 potential participants were invited per email to participate, of which 71 students filled in the questionnaire. After data cleaning, 52 participants (42 females, and 10 males) were included in the analysis, constituting a response rate of 26.3 percent. The students' ages ranged from 20 to 28 years ($M = 22.4$, $SD = 1.7$). The average group size of the hybrid cohort consisted of six students. The frequency of which the students met offline, and in some cases also online, with their supervisor varied between the groups.

Procedure

The data from both cohorts was collected as part of a study on various aspects of collaboration in bachelor thesis groups by the researchers who were currently working on the bachelor thesis project. Prior to the start of the data collection, the research proposal was approved by the Ethics Committee of the Faculty of Behavioral and Social Sciences of the University of Groningen (EC-BSS). No personal incentives were provided for participation in

the study. The data collection procedure as well as the timing of the data collection was identical for both the online and the hybrid cohort, with the addition of flyers used for recruitment only in the hybrid cohort.

The researchers, consisting of bachelor thesis students collaborating on the study, contacted fellow bachelor thesis students via WhatsApp and face-to-face contact. Further, the link to the questionnaire was sent to the participants' student email account by the secretary of the Psychology department, and additionally, a QR-code to the questionnaire was placed on a flyer that was given to the students of the hybrid cohort in person. In return for filling in the questionnaire, the collaborating students offered to participate in their respective bachelor thesis projects. Participation of all students was voluntary and anonymous, and each participant gave informed consent and was able to stop the questionnaire at any moment. As explicitly stated in the questionnaire, all data was treated confidentially. Data for both cohorts was collected for a duration of two weeks at a time point halfway through the thesis project.

The study was conducted online using the program Qualtrics (Qualtrics, 2021), consisting of a questionnaire which took the students 15 minutes to complete on average. Each participant could complete all scales using an electronic device of their choice with access to a stable internet connection. There was no time limit and participants could take a break from the questionnaire and continue filling it in at their convenience.

Materials

A questionnaire, consisting of various scales with 70 questions in total, was used to measure different aspects of collaboration in bachelor thesis groups. The participants completed demographic information as well as information about their respective bachelor thesis group. Specifically, these concerned data about their gender, age, nationality, of how many males and females respectively their group consisted of, as well as the total group size, including themselves. Subsequently, various variables were measured with different scales

regarding the students' satisfaction with the learning experience, perceived collaboration, well-being, teaching presence, social presence, perceived interdependence, individual control, group cohesion, and attitude towards collaborative learning. Additionally, the questionnaire contained a total of either two or three control questions for the online and hybrid cohort respectively, to detect random responding or careless participation, distributed over all scales. At the end of the questionnaire, participants were asked about the truthfulness of their responses, and they had the opportunity to leave written feedback. The entire questionnaire was conducted in English. In the following, only the scales that are relevant to the present study will be discussed with the internal consistency of each scale referring to the total sample ($N = 126$). For the original questions of each scale used for the current hybrid cohort, see Appendix A.

Level of Cooperation

To measure the level of cooperation in university groups, an adapted version of the *Questionnaire of Group Responsibility and Cooperation in Learning Teams (CRCG)* was used, which was initially developed by Leon-del-Barco et al. (2018). Out of the original 14 questions, only the six questions referring to the dimension of cooperation were used, which were asked on a 5-point Likert scale (1 = *Never*, 5 = *Always*). An example item includes "My group members have accepted criticism and suggestions positively.". For the six questions used in both the online and hybrid cohort, reliability was found to be high ($\alpha = .87$).

Social Group Cohesion

Social group cohesion was measured using ten items, which were rated on a 5-point Likert scale (1 = *Disagree*, 5 = *Agree*). These items were based on a scale created by Chung et al. (2020), which aimed to measure work group inclusion. In the original study, five items measure the component of belongingness ($\alpha = .90$), and five items measure the component of uniqueness ($\alpha = .88$). The items were adapted to the current context of collaboration in

bachelor thesis groups, and item 1 was scored reversely to detect response sets. Two example statements include: "I believe that my bachelor thesis group is where I am meant to be." and "People in my group listen to me even when my views are dissimilar.". The scale showed a good internal consistency within the two cohorts ($\alpha = .87$).

Satisfaction with the Learning Experience

Satisfaction with the learning experience was measured with a self-constructed 10 item scale, designed by bachelor thesis students who conducted the study involving the online cohort in the academic year of 2020/2021 (Funck, 2020). This scale was based on the definition of learning satisfaction from So & Brush (2008), explicitly defined as "an affective learning outcome indicating the degree of learner reaction to values and quality of learning" (p. 323). The students designed a 5-point Likert scale (1 = *Disagree,* 5 = *Agree)* with example statements including: "So far, I am satisfied with my interactions with my fellow group members.", as well as "This project maintains a good balance between being challenging and manageable.". For the 10 items used in both cohorts, reliability was found to be good ($\alpha = .84$).

Results

The collected data of both the online and the hybrid cohort was combined into one sample ($N = 126$) to examine if (1) CL is significantly related to SLE, (2) social cohesion is moderating the relationship between CL and SLE, and (3) if the learning context shows a direct effect on the group's cohesiveness.

The subsequent statistical analysis was conducted using the statistical software JASP (JASP Team, 2020), applied to the 126 eligible participants who completed the study.

Descriptive Statistics

The descriptive statistics of the summed scales are described as average scores across all participants, presented as one mean value per scale. As such, the mean response to the six

items of the CL scale was 3.8 (*SD* = .83), the 10 items to measure SLE had a mean response of 4.1 (*SD* = .65), and the 10 items of the cohesion scale showed a mean of 3.87 (*SD* = .66). An exhaustive summary of the descriptive statistics is displayed in Table 1.

Subsequently, the pairwise correlations between gender, age, CL, cohesion, and SLE were computed. Results indicated a moderately strong correlation between CL and SLE, a moderately strong correlation between CL and cohesion, as well as a moderate correlation between cohesion and SLE. Further, age was found to be significantly correlated with cohesion. An exhaustive summary of the pairwise correlations can be found in Table 2.

Table 1

Descriptive Statistics of the Summed Scales

	age	groupsize	CL	Cohesion	SumSLE
Valid	126	126	126	126	126
Missing	0	0	0	0	0
Mean	22.94	5.98	3.80	3.87	4.10
Std. Deviation	3.30	0.91	0.83	0.66	0.65
Range	21.00	8.00	3.33	3.00	3.00
Minimum	20.00	4.00	1.67	2.00	2.00
Maximum	41.00	12.00	5.00	5.00	5.00

Note. CL = Cooperative Learning. Cohesion = Social Cohesion. SumSLE = Satisfaction with the Learning Experience. *N* = 126.

Table 2

Pairwise Correlations

Variable		gender	age	CL	Cohesion	SumSLE
1. gender	Pearson's r	—				
2. age	Pearson's r	−0.27**	—			
3. CL	Pearson's r	0.12	−7.02e−3	—		
4. Cohesion	Pearson's r	0.13	0.17	0.53***	—	
5. SumSLE	Pearson's r	0.13	−0.14	0.51***	0.35***	—

Note. CL = Cooperative Learning. Cohesion = Social Cohesion. SumSLE = Satisfaction with the Learning Experience. $N = 126$.

* p < .05

** p < .01

*** p < .001

Statistical Assumptions

At first, case-wise diagnostics was applied to detect and subsequently remove unusual scores with standardized residuals outside of the range of [-3, +3]. According to this criterion, no further participants were removed from the dataset. Prior to the moderation analysis, it was assessed whether statistical assumptions hold for the given data.

For the purpose of checking for multicollinearity, the pairwise Variance Inflation Factor (VIF) for the variables CL, SLE, and cohesion was computed. Results indicate no inflation of variance (*VIF* = 1.39). Moreover, to test the independence of errors, as well as to detect the autocorrelation of the residuals, the Durbin-Watson test was conducted. The data met the assumption of independence of errors (*Durbin-Watson value* = 2.37, *autocorrelation* = - .19).

Regarding homoscedasticity and linearity, the plot of the predicted scores vs. the residuals shows no violations, as the values follow no systematic pattern or shape. Further, the normality assumption holds for the given data as the Q-Q plot displayed standardized

residuals being close to the regression line with minor deviations. Similarly, the standardized residuals histogram shows an approximate bell shape with a slight left skew.

Main Analysis

A multiple linear regression analysis was applied to examine main and interaction effects in the given data set, including both the online and hybrid cohort.

Satisfaction with the Learning Experience

Multiple linear regression was used to analyze if both CL and cohesion significantly predict SLE, applied to the 126 eligible participants of both the online and hybrid cohort. Initially, CL and cohesion were entered as independent variables (IV), to predict SLE as the dependent variable (DV). The overall model was significant, with both variables jointly explaining 27 percent of the variance in SLE (F (2, 123) = 22.74, $p < .001$). The extent of CL significantly predicted the SLE (t (126) = 4.95, $p < .001$). The direction of the relationship was positive, consequently, higher levels of CL predicted higher levels of SLE. However, the degree of social cohesion did not significantly predict the SLE within the multiple regression model (t (126) = 1.26, $p = .21$).

Moderation of Social Group Cohesion

Subsequently, an interaction term of social cohesion and CL was created to test for a significant moderation effect, using Hayes Process function (PROCESS v3.4, Hayes) of the software SPSS (IBM SPSS, Version 26.0, 2019). Results revealed that the moderation effect, consisting of the social cohesion*CL interaction term, was insignificant (t (126) = - 1.3, $p = .1959$), explaining merely an additional 1.02 percent of the variance in the SLE (*R2 change = .0102, F Change =* 1.69). In sum, the moderation model, consisting of the two variables, including the interaction term, explained 27.99 percent of the variance in SLE with the overall model being significant (F (3, 122) = 15.81, $p < .001$).

Collaborative Learning Context

To examine if the learning context of online and hybrid, consisting of a dichotomous categorical IV, differed significantly with regard to the developing social cohesion, a one-way ANOVA F-test was conducted. Cohesion was entered as the DV, and the two categories of CL context were entered as a fixed factor. To test for equality of variances, the Levene's Test was conducted. Results indicated no violation of homogeneity of variances (F (1, 124) = .88, p = .35). Subsequent results showed insufficient evidence of a significant difference of cohesion within the two learning contexts (F (1, 124) = 1.77, p = .19, $\eta2$ = .01). Additionally, a box plot was created (Figure 2), displaying the means and range of cohesion values of both the hybrid cohort (M = 3.96, SD = .61) and the online cohort (M = 3.8, SD = .69). The plot revealed that the online cohort displayed a broader range of cohesion scores with more people scoring at the lower end, compared to the hybrid cohort (*Mdifference* = .16).

Figure 2

Comparison of Mean Cohesion Values between Cohorts
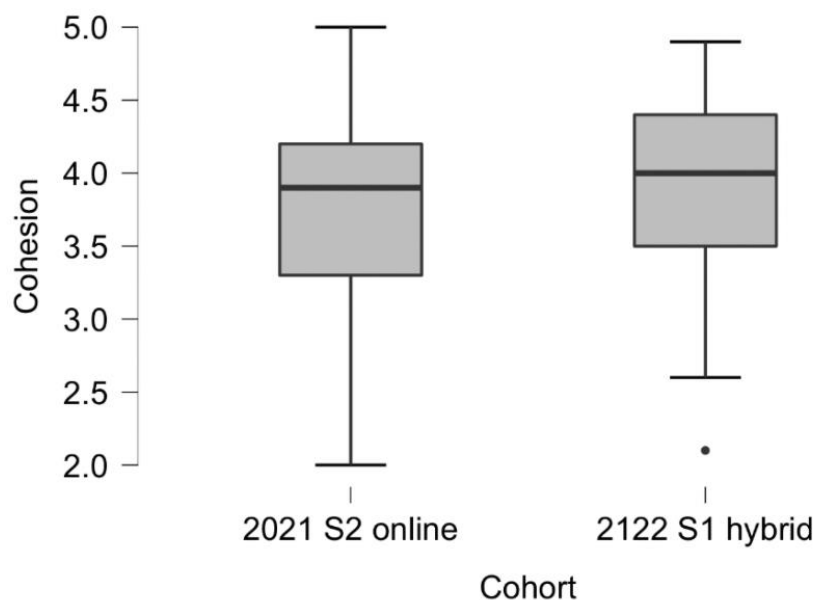
Note. Figure 2 describes the distribution of mean cohesion values within the online and hybrid CL context. Cohesion = Mean of the summed scale of cohesion. 2021 S2 online = Online cohort. 2122 S1 hybrid = Hybrid cohort.

Discussion

In the present study it was investigated whether collaborative learning approaches lead to a higher satisfaction with the student's learning experience, using two samples of both an online and hybrid cohort. In line with extensive research in the area of CL, higher CL should lead to more positive affective learning outcomes, holding in both the online and hybrid learning groups (Hypothesis 1). That is, CL potentially fosters the effective resolution of misconceptions, as learning content is openly discussed and attempted to be resolved, increasing student's engagement, commitment, and satisfaction (Rajalingam et al., 2018). However, research suggests that the conditions of CL play a role in student's satisfaction with CL, with the developing social cohesion being partly responsible for the relationship between CL and the SLE. Concretely, social cohesion potentially builds trust, so students are more willing to provide performance and task feedback to each other, integral for the effectiveness of and satisfaction with CL (Croy & Eva, 2018). Consequently, it has been hypothesized that collaboration under conditions of higher group cohesion would lead to a higher SLE (Hypothesis 2). Furthermore, because of, but not limited to, the global pandemic affecting educational practices, interest has increased in the effectiveness of both traditional offline teaching, as well as an increased implementation and complementary use of online CL instruction. As such, based on research showing social connectedness, intimacy, and trust building to differ in offline and online learning communities (Almusharraf & Bailey, 2021; van Tryon & Bishop, 2012), within this study it has been hypothesized that the CL mode directly affects the group's social cohesiveness (Hypothesis 3).

The results obtained in our study provide support for Hypothesis 1 of student's higher satisfaction with increased CL. In line with prior research, participants reported a higher SLE if increased CL was present within their bachelor thesis group work.

Unexpectedly, social cohesion did not moderate this relationship significantly, as CL itself was primarily responsible for student's SLE, providing insufficient empirical support for Hypothesis 2 of our study. As such, the present study deviates from research of the importance of interpersonal relationships for students' positive affect in CL.

During the global pandemic, requiring an immediate transition and adaptation to online education, social cohesion has been proposed as an important factor to cope with the current crisis in its role as a health promoting factor, fostering sustained motivation for engagement and learning (Wohlsifer et al., 2021). Consequently, different collaborative learning environments should exert differential effects on the social cohesiveness and its relative importance. However, cohesion did not differ significantly between the online and hybrid cohort within the present study. Consequently, the current study found insufficient support for Hypothesis 3.

Strengths

Some important strengths of the current study should be highlighted. First, present research could take advantage of the changes in educational structure in comparing the effect of online and hybrid CL on the student's SLE. That is, the study could benefit from a unique situation and use valuable findings to potentially improve the structure of the bachelor thesis project and collaborative group work in general. Relatedly, particularly during the global pandemic, impacting the mental well-being of each student, the current findings are worthwhile to inform novel strategies to support each student optimally in their learning.

Specifically, the current results show that CL within bachelor thesis groups exerts a positive effect on student's SLE, independent of the developing social cohesiveness. Furthermore, the positive effect of CL does not depend significantly on the learning environment, as there were no differences found regarding the group's social cohesiveness. This is an important strength, as online education and class sizes are only assumed to

increase, similarly to the increasing diversity, interconnectedness, but also competitiveness among students at different universities (Gorvine & Smith, 2015). As such, CL implemented both online and offline could help overcome these current educational challenges. Conclusively, present research could lead to increasing efforts into integrating CL within online environments in which students of multiple places can be brought together to potentially cooperate well and benefit academically, as well as socially.

Limitations and Future Directions

One limitation of our study lies in its research design being merely correlational. As such, our design can only support associations but might not be appropriate to draw causal conclusions about our variables of interest. Conclusively, future studies should employ quasi-experimental and experimental designs to acquire more certainty in the strength and direction of the effects. Further, although SLE is a desired outcome and shows significant relationships with academic performance and psychological well-being, future studies should incorporate longitudinal study designs to examine if the effect of the SLE holds over extended time periods and if it translates into quantifiable outcomes, such as high grades and academic achievement. Specifically, research could study the long-term effect of SLE regarding sustained motivation, engagement in future CL, as well as the development of more professional and group skills, such as problem-solving, perspective-taking, and consensus building.

A second limitation lies in our participants being recruited through convenience sampling, with no randomization to different modes of CL. Therefore, validity is limited by factors not controlled for by the design of our study and could be increased in future studies by randomly assigning participants to different CL conditions. That is, prior research suggests that the group composition of CL might influence the student's SLE, with a difference between self-selected, randomly assigned, or instructor-selected CL groups (Croy & Eva,

2018). Within this framework, individual difference variables can be controlled for, such as mental health, or attitude towards cooperative groupwork.

Relatedly, the current sample is limited in its explanatory power due to low response rates of around 25%. That is, students who participated could show differences in important variables, such as a higher willingness to cooperate, in contrast to students who did not participate. Similarly, the total sample is constrained to a specific population, consisting of educated students from Western society. Consequently, future studies should examine the effects of CL within different populations and educational levels to increase generalizability.

A third limitation lies in the construction of scales and its assumptions. Even though reliabilities were strong for each scale, the fact that some scales were only partly administered could have influenced the results of our study. Relatedly, the scale intended to measure social group cohesion might have inadequately captured the concept found in the literature because of its broader focus on the sense of group belongingness and its exclusion of the component of task cohesion. Specifically, the cohesion scale used within our study focuses more on feelings of acceptance and inclusivity, in contrast to contemporary cohesion scales, including task cohesion, group member's motivation, and engagement (Miyake & Kirschner, 2014; Croy & Eva, 2018). Thus, future research should employ a variety of scales or scales in combination to explore if the effects differ.

Simultaneously, all scales relied on self-report data which can introduce potential cognitive biases or deliberate dishonest responding (Tempelaar et al., 2020). As such, we only measured the perceived extent of variables such as CL and social cohesion, but not the extent that the groups objectively collaborated and supported each other. Consequently, future studies should consider integrating behavioral measures, such as observations, with self-report data to increase accuracy and compensate for response biases.

A fourth limitation addresses the circumstances of our study, as all variables were measured in an online environment during the exceptional time of a global pandemic. It follows that the SLE might not generalize to student's affect in regular distance learning courses, in which there was more time to design and tailor the learning environment to the specific learning content. Further, students' expectations towards CL might differ significantly between regular online courses and a rapid shift to online education, suggesting that future studies should compare the SLE in on-campus CL with regular online CL courses. Additionally, due to shifting educational circumstances during the studies conduction, the current offline CL cohort developed into a study of hybrid CL, which might have affected the outcomes of our study such as student's SLE or opportunities to establish social group cohesion.

Theoretical Implications

The current study contains important theoretical implications, valuable for future research and wider educational practices. At first, the study shows the importance of CL practices within higher educational environments, irrespective of its mode. Research shows CL, involving interdependent goals, to influence the individual's attitudes and beliefs about teamwork and to provide social norms which positively influence productivity and affective outcomes (Johnson & Johnson, 2009; Croy & Eva, 2018). Especially the elements of feedback, peer assessment, and critical thinking CL group tasks have been shown to foster the development of supportive interpersonal relationships, appreciation of each other's input, commitment, and overall knowledge retention (Lai et al., 2020).

Importantly, the current study did not find an effect of neither social cohesion as a moderator of CL, nor a direct effect of the CL mode on cohesion. Within the literature, cohesion has been repeatedly shown to be integral for effective team functioning in CL, as it provides a supportive learning environment to connect to others by fostering a sense of safety

and attachment, essential for student's mental health and motivation, and ultimately sustained SLE (Croy & Eva, 2018; Wohlsifer et al., 2021). However, given the insignificant contribution of social cohesion within the current study, it can be concluded that elements of CL itself lead to a higher SLE. Concretely, elements of the CL learning scale such as mutual encouragement, constructive conflict resolution, as well as the provision of constructive feedback and criticism might foster student's positive affect. Importantly, these elements reflect feelings of social cohesion, in addition to items such as equal participation, task commitment, and fluent cooperation reflecting task cohesion, both included in the current CL scale. Crucially, these elements are common themes of cohesion scales in the literature (van Tryon & Bishop, 2009; Croy & Eva, 2018; Altebarmakian & Alterman, 2019; Miyake & Kirschner, 2014). Conclusively, this might explain the insignificant effect of cohesion in our study, which is more focused on individual feelings of social belongingness.

Regarding the importance of the learning environment, on-campus CL should facilitate attention, social connection, effective interaction, and supportive relationships, in contrast to online CL, in which there are multiple distracting factors and limited possibilities for spontaneous interaction (McLeod, 2016; Wohlsifer et al., 2021). Conclusively, especially in unpredictable times such as the global pandemic leading to a shift of CL to be exclusively implemented online, a difference in social cohesiveness was expected. However, the present research shows that social cohesion can be established in both hybrid and online learning environments. Thus, despite potentially higher challenges of connecting socially online, our research provides evidence for positive group dynamics not to be impeded by the mode of CL. This implies that collaborating groups can potentially become cohesive regardless of their mode of learning, and that merely collaborating online does not impact the group dynamics negatively.

However, as previously implied, the current social cohesion scale employed shows important differences regarding its main themes, in contrast to the literature. Specifically, the literature includes little content regarding individual's feelings of belongingness, group esteem and value, in contrast to the current cohesion scale. Rather, it is focused on task roles, engagement, and trust regarding the purpose of the group work, including mutual respect, free expression of opinions, and interpersonal acceptance as common themes. Thus, direct comparisons and conclusions based on the current cohesion scale, and the cohesion scales used in the literature should be made with caution.

Additionally, it has been proposed that social group cohesion exerts its differential effect rather over time and is not sufficiently evident at the beginning of CL, such as measured in the current study. Particularly the establishment of trust, intimacy, and social connectedness might require more time and support to emerge, especially in online CL due to the impeded fluency of social interaction (van Tryon & Bishop, 2012). Thus, studied longitudinally, there can still be differences emerging between the two CL learning modes regarding its social cohesiveness.

Practical Implications

Nowadays, there is an ongoing challenge in higher education to implement CL, as class sizes are large and resources for small group teaching are scarce. In combination with the increasing anonymity between teachers and students, many instructors fail to identify how to best support students and resolve educational challenges (Gorvine & Smith, 2015). As a result, most students lack appropriate social and teamwork skills, even if they are naturally assumed at university level (Mendo-Lázaro et al., 2018).

CL models can be implemented in universities with the effect of enhancing students' social and effective communication skills, as well as a more positive and enjoyable evaluation of the learning process (Sawyer & Obeid, 2017). As such, the most proximal practical

implication concerns the structure of the bachelor thesis project. Concretely, as the positive effects of CL do not differ between online and hybrid implementation, efforts should not be solely placed on bringing students together on campus, but rather to combine online and offline teaching methods to facilitate CL and save (financial) resources. Given the student's high positive affect following CL, reflected in the gain and application of knowledge and academic skills, as well as in positive experiences with the flow of communication, and use of time and resources, these CL elements should be increased within bachelor thesis groups. As such, interventions could be focused on the setting of CL, the optimal group size, the specific role of the supervisor, and interactive elements of CL, such as peer feedback, collaborative writing, and small-group discussions.

CL can be an effective solution against the disadvantages of disengagement of students within increasing class sizes and mass learning in lecture halls and can be implemented complementary to lecture-based learning (Cohen & Robinson, 2017). Following our research, elements contained in the present CL scale such as equal participation and commitment, as well as mutual encouragement, solidarity, and constructive conflict resolution should be increased to profit most from working collaboratively.

Our findings can be connected to novel ways to implement CL and new variables to consider. Concretely, to provide optimal conditions for student's productivity and commitment, CL should be implemented regularly and early in the student's curriculum, and feedback should be given frequently and anonymously (Croy & Eva, 2018). Recent studies show that CL approaches can be combined with flipped classroom instructions, consisting of pre-class online lectures and texts, in-class activities such as small group discussions, and after-class assignments like peer feedback and reflections. Consequently, the combination of both methods, termed team-based flipped learning, produced higher quality group discussions in CL, and similarly increased intrinsic motivation, subjective task value, self-efficacy beliefs,

and commitment to group's goals (Lai et al., 2020). Importantly, Fransen et al. (2013) indicate that both task-related skills such as open exchange and consensus building, as well as team-related skills like group cohesion and role relatedness, must be built over time for the most effective CL to occur.

Conclusions

Taken together, the present study shows the importance of CL for the student's positive affect in higher educational environments. Student's CL fosters both academic and social skills through knowledge gain, but also tolerance, respect, and prosocial attention. As these qualities are becoming increasingly important within the workplace as much as for the well-being of our global society, research should continue to explore novel ways to support CL in various settings and circumstances.

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Appendix A

Items per Scale of the Questionnaire

Perceived Collaboration / Cooperation

Q9

*Please indicate to what extent the following statements apply **to your group members***

1. My group members have encouraged the others.

2. My group members have positively solved the conflicts and problems in the group.

3. My group members have accepted criticism and suggestions positively.

4. My group members have acted with solidarity and a high degree of cohesion.

5. My group members have collaborated simultaneously in the performance of the tasks.

6. My group members have cooperated with each other.

(1 = never, 2 = sometimes, 3 = about half of the time, 4 = most of the time-, 5 = always)

Sense of Belonging / Group Cohesion

Q11

Please indicate to what extent the following statements apply to you

1. I don't feel like I belong in my bachelor thesis group

2. I feel that people support me in my group

3. I can bring aspects of myself to this group that others in the group don't have in common with me

4. People in my group listen to me even when my views are dissimilar

5. Whilst in meetings, I am comfortable expressing opinions that diverge from my group

Q12

Please indicate to what extent the following statements apply to you

6. I am treated as a valued member of my bachelor thesis group (1)

6.   I belong in my bachelor thesis group (2)

6.   I am connected to my bachelor thesis group (3)

6.   I believe that my bachelor thesis group is where I am meant to be (4)

6.   I feel that people really care about me in my bachelor thesis group (5)

(1 = Disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, 5 = agree)

Satisfaction with the Learning Experience

Q6

The following questions are about your experiences with your bachelor thesis project until

now. Please indicate to what extent the following statements apply to you.

During this project I have the opportunity to…

1. ... gain a lot of useful knowledge

2. ... expand my research skills

3. ... apply previously acquired knowledge/skills

4. … learn from my group (including supervisor)

Q7

So far I...

5.   … am satisfied with my interactions with my fellow group members

5.   … am satisfied with the use of time within meetings

5.   … am satisfied with the communication of ideas and information

Q8

This project…

8.   … is a good learning experience

8.   … is valuable for the next step in my career

8.   … maintains a good balance between being challenging and manageable

(1 = Disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, 5 = agree)