Ella Anghel, BOSTON COLLEGE, anghel@bc.edu

The Good, the Bad, and the Pandemic: An Intra-Group Approach to Exploring Students' Experiences with Collaborative Learning During COVID-19

ABSTRACT

Collaborative learning is increasingly common in higher education, with several studies pointing to its effectiveness. However, it also poses some social and cognitive challenges for students, resulting in students' mixed attitudes toward collaborative learning. COVID-19 has added to these challenges by, for example, introducing barriers to face-to-face communication. Existing studies exploring the impact of COVID-19 on students' experiences with collaborative learning focus on individual students, missing potential intra-group trends that could be useful to instructors. Using both Likert-style and open-ended questions, this study explored 38 college students' experiences engaging in collaborative learning during COVID-19 both individually and at the intra-group level. Overall, students' experiences were positive both academically and socially, though some experienced challenges such as freeloading and online connection issues. For most groups, there were one or two students who had negative experiences, but these issues seemed to be individual and not indicative of a group-level problem. The study introduces an intra-group approach to collaborative learning research. Its findings suggest that instructors should apply collaborative learning pedagogies to enhance students' learning and social connectedness. Instructors could further improve students' experiences by identifying and solving common issues (e.g., freeloading, technical difficulties) by surveying students or encouraging them to share these difficulties with the instructor.

KEYWORDS

collaborative learning, group work, students' experience, COVID-19, mixed-methods

INTRODUCTION

Collaborative learning (CL), students working together in small groups, is considered to be an effective tool in enhancing students' learning (for meta-analyses on the effectiveness of CL in various contexts, see Capar and Tarim 2015; Jeong, Hmelo-Silver, and Jo 2019; Sung, Yang, and Lee 2017; Talan 2021). However, many students dislike working in groups and raise issues, such as conflicts among group members and social loafing (people being less productive when working in groups than individually; Simms and Nichols 2014). Some of these issues can be intensified when students cannot meet in person (Ku, Hung, and Akarasriworn 2013) and when they face other stressors, as was the case at the height of the COVID-19 pandemic. Although some studies explore the impact of the pandemic on students' experiences with CL, they generally focus on individuals and ignore intra-group interactions, that is, patterns of students' experiences relative to those of their group members. Looking at intra-group trends in students' experiences could reveal specific group dynamics that lead to better or worse learning

CC-BY-NC License 4.0 This is an Open Access article distributed under the terms of the Creative Commons – Attribution License 4.0 International which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly attributed.

experiences, helping instructors identify and address potential issues. The current study sought to explore students' attitudes towards CL during COVID-19 at the individual and intra-group levels. The study is expected to have two main contributions to the literature. The first is an expansion of the understanding of students' experiences with CL and what affects them, particularly during a global crisis. The second contribution is the exploration of students' experiences in the context of interactions with their group members. Both of these goals may help instructors plan CL activities in ways that mitigate the problems expressed by students, enhancing their experience and their learning.

Literature review

Multiple definitions of CL exist in the literature (Laal and Laal 2012), mostly involving problem-solving in small groups. In her review, Hodges (2018) defines CL as the use of group work in class to address questions, solve problems, and/or process ideas. According to Hodges, CL can be implemented using various pedagogical methods such as peer discussion, problem-based learning (where students solve complex problems over multiple sessions), or team-based learning (where students address application questions in quizzes or exercises). Regardless of the specific method, many studies support the effectiveness of CL in enhancing students' learning and engagement (Jeong, Hmelo-Silver, and Jo 2019) as well as other important outcomes of higher education such as higher-order thinking and various social and interpersonal skills (Cabrera et al. 2002; Karantzas et al. 2013; Skinner et al. 2016)

Nokes-Malach, Richey, and Gadgil (2015) describe multiple cognitive and social mechanisms in which CL contributes to learning. Some cognitive mechanisms involve one group member's knowledge complementing or cuing another's (Congleton and Rajaram 2011; Sangin et al. 2011), group members correcting each other's misconceptions (Khosa and Volet 2014), and increasing learners' working memory resources (Kirschner, Paas, and Kirschner 2011). From a social perspective, CL is expected to contribute to learning by allowing learners to observe others (Bandura 1986), increasing task engagement (Giel et al. 2021), and discussing multiple points of view, such that the learner has multiple representations of knowledge (Voiklis and Corter 2012). All of these mechanisms suggest that CL works when students are engaged in meaningful learning rather than simply working in the presence of other people. Students who have positive attitudes towards group work also often mention these benefits (So and Brush 2008; Sweeney, Weaven, and Herington 2008).

However, CL also presents some cognitive and social challenges (Nokes-Malach, Richey, and Gadgil 2015). Learners might struggle to coordinate the different problem-solving strategies, increasing their cognitive load to the point of ineffectiveness (Nokes-Malach, Meade, and Morrow 2012). Another cognitive challenge is interference with retrieval, for example, when a group member misses an opportunity to retrieve relevant information because they had to wait for their turn or had to listen to their partners (Rajaran and Pereira-Pasarin 2010). CL poses some social challenges as well, such as dealing with freeloaders and self-censoring due to fear of others' opinions. Many of these challenges are often mentioned by students as reasons why they prefer working individually (Burdett and Hastie 2009; Ludlum, Conklin, and Tiger 2021; Machemer and Crawford 2007).

While the aforementioned processes associated with CL are general to any context, others are more specific to how and where CL is applied. One context that attracted the attention of researchers is online environments, as this setting introduces possibilities for collaboration without the need for physical proximity (Zhu 2012). For example, the online setting introduces new challenges such as

scheduling issues and a lack of face-to-face interactions (Ku, Hung, and Akarasriworn 2013). These issues were notable during the COVID-19 pandemic when many instructors and students were faced with the need to adapt CL to virtual environments (Gemmel et al. 2020). Technical difficulties, particularly among students with a lack of access to infrastructure (internet connection, electricity), made it harder for students to work in groups (see Frei-Landau and Avidov-Ungar's 2022 work in Israel and Omodan and Ige's 2021 work in South Africa). On the other hand, Lei and Medwell (2021) found that CL was particularly valuable during the COVID-19 lockdowns in China as it allowed students to have at least some connection with other students, providing them with emotional support. It seems like the pandemic was an important factor in understanding students' experience with CL, introducing both unique challenges and opportunities.

Although these existing studies provide a valuable perspective on students' experiences with CL during the pandemic, more research in different locations and courses could increase the utility of the findings. That is, practitioners could apply the conclusions and recommendations that seem more relevant to their context. Methodologically, these studies, similar to other works in the field, focus on the attitudes of individual students. An alternative yet complementary approach is looking at students' experiences within the context of their group members'. This intra-group approach could reveal some insights about which elements of their group worked well and which did not, and if the students agree on what did and did not go well. Exploring students' experiences relative to their group could help identify and address common conflicts or issues among group members, thus improving the CL experience for all.

The current study uses mixed methods to explore college students' perceptions of how CL impacted their learning during the pandemic. It adds to the existing literature on the topic by exploring this question in a new context as well as by examining potential intra-group patterns of attitudes toward CL.

The research questions of this study are:

1. How did students perceive the effects of CL on their learning during the COVID-19 pandemic?
2. What were the intra-group patterns of experiences?

METHOD

Context

This study focused on a second-year research methods course in a four-year applied psychology program at a large suburban research university in the United States. The course was offered in the spring semester of 2021 (February–May). Due to the pandemic-related restrictions, most of the classes were given synchronously via Zoom. Additionally, the students were expected to watch recorded lectures at home before each class. A large proportion of the Zoom classes was dedicated to working in groups. There were 11 groups of three to five students each. These groups were formed in one of the first classes and remained the same throughout the semester. The groups were mostly formed by the students with some assistance from the instructor when needed. Both decisions, to have the students self-select the groups and to have the same groups throughout the semester, were made for pedagogical reasons and not for research reasons. Self-selection was assumed to improve students' learning by allowing them to engage with other students they work well with. Having the same groups throughout

the semester was assumed to enhance the bonds among the students in a way that allowed them to support each other's learning.

There were several types of group activities in this class. First, some of the class activities and discussions were done in groups. For example, in one class each group read a research paper and answered questions related to its methodology, then presented it to the rest of the class. Second, each group had to submit six homework assignments throughout the semester. They were given some time during class to work on these assignments but met outside class to complete the assignments if needed. Three of these homework assignments involved reviewing and practicing the material (e.g., identifying research designs of a study, types of validity, etc.) The other three were designed to help each group plan their own research study and write a research proposal by the end of the semester. For example, in the first assignment, the students were required to come up with potential research questions and summarize a few research articles relevant to these questions. The six homework assignments were graded for completion and constituted 15% of the students' final grades. Finally, each group submitted a full research proposal at the end of the semester. Students in the same group received the same grade, which was 20% of their final grade. The rest of the students' final grade consisted of individual exams and class participation.

Note that all of the group activities are pedagogical implementations of collaborative learning as described by Hodges (2018)—peer discussion during class, working on application questions in the homework assignments, and a larger-scale project involving the complex problem of designing a research study. In addition, considering the cognitive and social mechanisms that make CL beneficial, the groups were encouraged to share their knowledge and perspectives and to ask the instructor for help whenever needed.

Participants

All of the students in the course (40) were asked to participate in the study, and 38 of them agreed to do so; one of them only filled out the Likert-style part of the survey. Most of the students were female (92%), and white (61%). In order to protect students' anonymity, individual-level demographics are not reported in this study. A numeric code (1–38) was assigned to each of the students and a letter code to each group in order to describe their responses.

Procedure

The students were asked to take an online questionnaire during one of the last class sessions for course evaluation purposes, but they were also asked to give their permission to use their responses for research purposes. They were not compensated for their participation. The author of this manuscript, who was also the instructor of the course, was not aware of which students participated or their responses until after the course was completed; this was also communicated to the students in order to avoid biasing their responses.

Measures

Demographic questionnaire

The participants responded to questions about gender, race, major, etc.

Open-ended section

The participants were presented with five open-ended questions about their experiences in the course (see Appendix A). They were asked about how their groups were formed, general satisfaction with their groups, how COVID-19 affected their group work and experiences in class, and if there were any other comments they would like to share.

Likert-style section

The participants reported their attitudes toward group work using 10 items adapted from Marks and O'Connor (2013). Their items were revised in several ways. First, two of the original 12 items ("In general, the grading process is fair." and "In general, the group process is managed well by the professor.") were not used; the first because the grading process had not been completed at that point, and the second because the professor was not the focus of this study. Second, some of the items were altered to refer to experiences in the specific course as opposed to attitudes towards group work more generally (e.g., "In general, groups work effectively," was changed to "My research group worked effectively"). This was done to better reflect both general and course-specific attitudes toward group work, as both of them seem to be important when predicting CL outcomes (Anghel 2022). Two subscales resulted from this, representing satisfaction with group work in general and satisfaction with group work in the target course (see Table 1). The subscales' Cronbach αs were .90 and .91, respectively. Finally, the original items were scored on a five-point Likert scale (1—strongly agree to 5—strongly disagree). However, to avoid confusion, they were recoded so that lower scores indicated disagreement with the items.

Sociometric section

Finally, the participants were asked to "select the students you interacted with at least once about this class (either in your research group or in other contexts, such as studying for exams)." They were then presented with a list of all of the names of the students in the class. Although the students were not restricted to naming only their group members, it was expected that most interactions occurred within the groups. For each of those students, the participants also reported the frequency of the interaction: once, two or three times, once a week, or more than once a week. The students also reported their interactions with other students outside of class in a similar sociometric questionnaire, but these results are reported elsewhere (Anghel 2022).

Analysis

Several strategies were used to answer the research questions. For the Likert-style items, the scores' general direction was used, where a score of three was determined to represent neutral attitudes towards group work, higher scores represent more positive attitudes, and vice versa. The subscales of attitudes toward group work in general and in the current course were examined separately. As an exploratory test, a paired *t*-test was used to compare the scores and see if the group work in this course was more satisfactory in comparison with what students expected or had experienced previously.

The open-ended items were first exploratorily coded for positive, negative, or mixed attitudes based on students' responses to the question about their general feelings towards their group work (i.e., regardless of specific challenges the students mentioned later). Students were coded as "positive" if they only mentioned positive aspects and did not mention any negative aspects when describing their general

feelings toward group work, and vice versa; if both positive and negative attitudes were mentioned, the students were coded as having mixed attitudes. Since few students were coded as "negative," students with negative and mixed attitudes were grouped together as "non-positive." Students with positive and non-positive attitudes' scores were compared using an independent means *t*-test in order to validate the coding. Then, students' responses were coded for specific positive and negative aspects of group work in general and as related to COVID-19. These codes were then grouped into themes, as presented in the results section.

In order to explore intra-group attitudes, both the qualitative codes and the Likert-style scores were examined. In particular, patterns of general agreement or disagreement, in terms of positive and negative attitudes, were explored. Then, I suggested reasons for any gaps based on the specific opportunities and challenges raised by the participants. For example, if one student had a negative experience but others in their group did not, the student's specific difficulties, as expressed in their open-ended responses, were examined, and possible conclusions were drawn based on these difficulties and their comparison with other group members' experiences.

To assist with visualizing the relationships among participants, I used the graphing software Gephi (Bastian, Heymann, and Jacomy 2009). In this case, Gephi allowed for easy identification of groups and the relationships within them. The social networks were generated based on the sociometric questionnaire, such that participants who mentioned each other were linked. Since it was possible for student A to mention student B but not to be mentioned back, the graphs are bidirectional. That is, the links among the students were drawn as arrows such that an arrow pointing from student A to student B exists if student A mentioned student B, and vice versa. In addition, the arrows vary in thickness, depending on the frequency of the interactions. This allowed for a more in-depth exploration of students' attitudes relative to the frequency of their interactions with other students. The data of students who did not consent to participate is not presented here, even if other students mentioned them as a part of their network.

RESULTS

How did students perceive the effects of CL on their learning during the COVID-19 pandemic?

Table 1 presents the means and standard deviations of the items in the scale on attitudes toward group work. For all of the items, the mean scores ranged from 3 to 4, suggesting relatively positive attitudes toward group work. Looking at the subscales, the mean satisfaction of group work in general was 3.14 ($sd = 0.60$), and the satisfaction from group work in the current course was 3.81 ($sd = 1.03$). While the scores were highly correlated ($r = .41$, $p = .010$), the satisfaction from group work in the current course was significantly higher than the satisfaction from group work in general ($t(37) = 4.28$, $p < .001$, Hedges' $g = 0.78$).

Table 1. Students' attitudes scale results

		Mean (SD)
General	I prefer to work in a group or team on class projects, as opposed to working individually	3.26 (1.06)
General	Working in a group results in better mastery of course material	3.11 (1.13)
General	Group work benefits my course grade	3.53 (0.89)
Specific	I enjoyed working in groups in this class	3.82 (1.16)
General	Group work should be used more often in classes	3.16 (1.08)
General	I find classroom group work socially rewarding	3.34 (1.21)
Specific	My research group worked effectively	4.00 (1.23)
Specific	My research group members fairly shared the workload	4.00 (1.34)
Specific	In this class, I learned more working in a group than when I worked alone	3.34 (1.19)
Specific	Group work was a positive experience in this class	3.89 (1.13)

In order to explore the individual students' specific positive or negative experiences, I analyzed the responses to the open-ended items. In general, the students reported that working in groups was a positive experience. The responses of 73% of the students were entirely positive, and the responses of 19% were mixed, mostly describing positive experiences with some specific challenges. Only 8% of the students viewed the group work negatively or were indifferent to it. After grouping all students with negative and mixed attitudes together, there were no significant differences in the mean general attitudes towards group work score between students with positive ($M = 3.35$, $sd = 0.96$) and non-positive attitudes ($M = 2.92$, $sd = 0.83$; $t(35) = 1.34$, $p = .095$, Hedges' $g = 0.45$), though the effect size is quite strong such that students with positive attitudes based on their open-ended responses also had positive attitudes towards group work more generally. However, students with positive responses ($M = 4.01$, $sd = 1.05$) had significantly more favorable attitudes towards group work in this course in comparison with the other students ($M = 3.14$, $sd = 0.65$; $t(35) = 2.45$, $p = .010$, Hedges' $g = 0.88$). Both results support the validity of the qualitative coding.

The students described multiple advantages and disadvantages of CL that can be divided into several interconnected themes: academic, social, and technological aspects of their experience engaging in CL during COVID-19. A summary of these themes is presented in Table 2.

Table 2. The study's themes with illustrative quotes

	Academic	Social	Technological
Advantages	"It was really helpful to bounce ideas off of each other and ask each other questions." (G26)	"I enjoyed my group members. Since I already knew one person, I was happy to be able to see her and felt comfortable with her." (J10)	"It [using Zoom, EA] was nice because friends and I would zoom to discuss some material instead of going across campus." (I13)
Disadvantages	"I don't necessarily feel that group work allows me to learn in [sic] the material in greater depth." (K21)	"At times I got frustrated when a member did not follow through with their planned part, and I had to contribute more to make up for the missing parts." (H20)	"Being on zoom is a more difficult environment for [me], I have trouble with distractions." (A7)

Academic aspects

This theme involves parts of CL that helped or interrupted students' learning, including dividing up work, asking each other questions about the material, etc. Overall, students felt that the groups worked well together and were very goal-oriented, striving to complete their assignments as effectively as possible. Many students made comments similar to "Our group worked well together and is typically productive and efficient" (participant E5). It seems like rather than working together, most students split up the work to save time, "hold[ing] each other accountable for our specific responsibilities" (C31). Others worked in a way closer to the CL ideal: "Everyone is willing to contribute and learn from each other" (I8), and "assignments were easier when we put our heads all together" (J10).

The students did not only collaborate on the course assignments, but they also helped each other with the rest of the course's material. One student said, "I feel comfortable reaching out to group members with questions about class and have learned from them in a way that makes me more confident" (I33), and another said, "it is helpful because it allows me to to [sic] realize certain topics I don't understand as well as I thought I did and I feel more comfortable asking those questions in a smaller group setting" (J27). That is, working with a small group of people helped students ask questions they would otherwise be less likely to ask.

Not only were the students able to ask each other questions about the course material, but some students said CL helped them think more deeply about the course material: "I like working with a group because I am introduced to information that I would have never thought of, which makes it interesting and proactive" (A32). However, CL had some negative impacts on students' learning, like getting conflicting answers to questions within the group or not being able to learn the material in depth. These challenges were each mentioned by one student, suggesting that while most students benefited from CL academically, some individual students did not.

Social aspects

The social aspects of CL include any mentions of the relationships among students and how the group setting affected them. Often, these relationships were related to students' learning and the

aforementioned academic aspects of students' experiences. For example, as mentioned in the academic theme, most students seemed to have gotten along well with each other and felt comfortable discussing the material and asking each other questions. In fact, some students enjoyed working with their friends so much, "we would get distracted causing assignments to take longer to do" (C16). Beyond the academic impact of the relationships within the group, the groups also have helped students "gain connections with others in my major" (F35) beyond the course itself. So, CL was generally perceived as a positive experience socially.

However, some students mentioned challenges that made group work frustrating. The most common concern was having one or more freeloaders in the group: "Many of my group members did not put in a lot of efforts [sic] to the assignments. I found myself really picking up their slack which was definitely frustrating" (A7). This was mentioned by several participants. One participant had similar concerns about having to hold others accountable, but did not think the other group members were completely freeloading: "it got done [the assignment, EA] but I would have to deal with people not responding to meeting times or I would have to pester and ask if things had gotten done that were other people's responsibility" (F9).

In addition to these issues, many students said that while getting close to the other group members was an advantage of working in groups, the virtual meetings limited this opportunity. In the words of one student, "In person you may develop friendships with people you complete group work with, but on Zoom you usually just want to get it over with quickly" (J6). So, the online setting allowed students to meet and create new relationships, but it was less conducive to social connections in comparison with in-person group work.

Technological aspects

This theme includes students' experiences associated with the use of technology to facilitate remote learning, most commonly the use of Zoom to communicate with group members. These aspects are directly related to COVID-19, as the use of Zoom was the result of having to learn remotely because of the pandemic. As mentioned above, the use of Zoom was related to the students' social experiences, but it affected their learning as well.

The main opportunity students mentioned was related to how working remotely made it easier for them to find times for meetings despite their busy schedules: "It was probably easier than trying to meet in person" (E14), and "It is also more convenient to meet online because we don't have to meet in person to complete assignments and can meet later at night to accommodate better for everyone's schedules" (J27). Similarly, some students felt like having to meet virtually "saves lots of time" (J10), and even said they would have met virtually regardless of COVID-19 because they are used to it and because it is more convenient. So, many students did not mind having to conduct group meetings virtually and found it easier to do so in comparison with in-person meetings.

Although the use of remote communication was more convenient, it also raised some technical problems that inhibited their ability to work together successfully. This caused some students to be at least perceived as freeloading. For example, one student "had connection problems and been unable to contribute as well as I would have liked at times" (A12). Similarly, from the perspective of another student in a different group, "sometimes a specific group member doesn't participate or turns their camera off, which is unfair to the rest of us" (I13). The technical difficulties caused or at least enhanced some of the freeloading issues mentioned above.

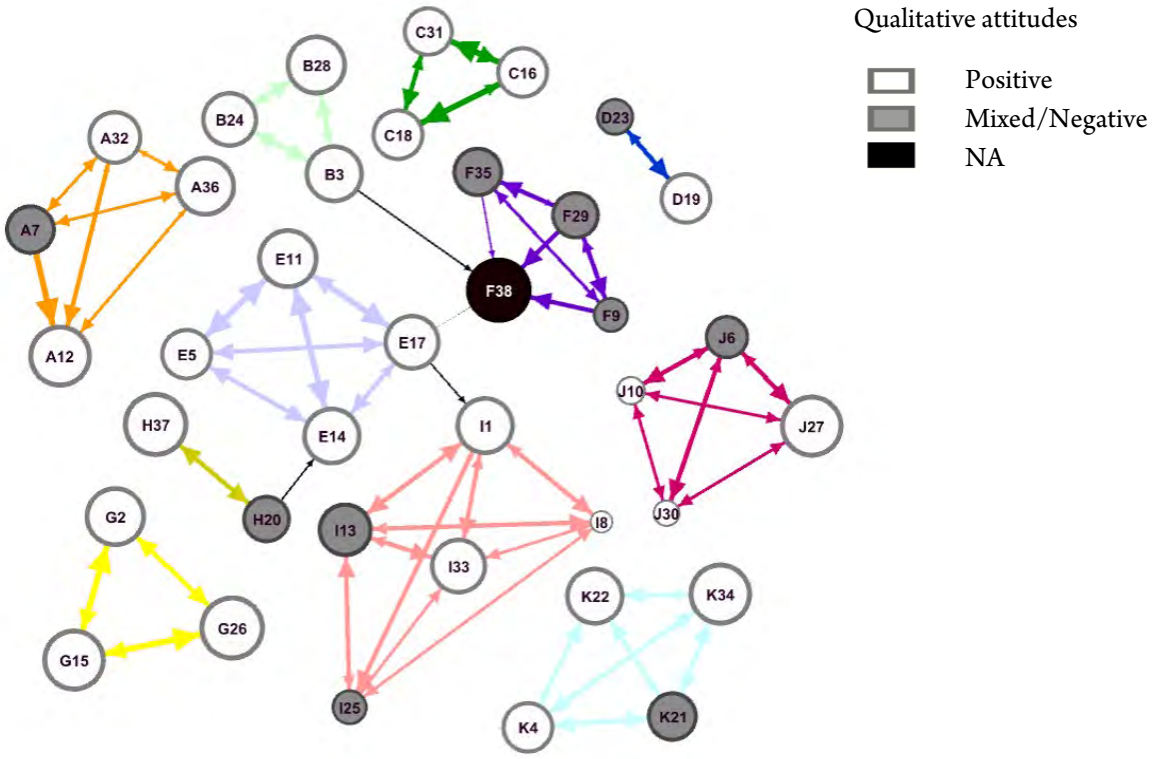
Even without technical difficulties, communicating virtually posed some challenges for focus and engagement. One student complained that if a room is not well-lit or if a student had to wear a mask (e.g., if they work in a public space), it is difficult to see and understand them. Other students mentioned "Zoom burnout," a feeling of fatigue caused by overusing online platforms like Zoom that is attributed to having to be constantly aware of nonverbal cues of yourself and others and a lack of interpersonal connection (Samara and Monzon 2021). In the words of one student, "Zoom does not allow for the most engaging setting" (K21). This was also true in this class in general, not only the group work part of it. Having to work remotely, often from their dorm room, caused some distractions and introduced additional challenges: "I struggle to pay full attention to the zoom session because of distractions in my dorm room" (G26). Put simply, many students expressed sentiments like "I have difficulty paying attention to virtual classes" (G15).

To answer the first research question, it seems like both the quantitative and the qualitative results suggest that overall, CL helped students learn during the pandemic. Having to work as a group resulted in more effective learning while also providing opportunities to connect with others at a time when such connections were limited. However, engaging in CL raised some academic, social, and technological challenges that made the learning process less effective and/or less enjoyable. While the academic and social challenges are relevant to CL in any context, they were augmented by factors related to the online platform and the pandemic (e.g., communication issues, Zoom fatigue).

What were the intra-group patterns of experiences?

To understand intra-group patterns, I looked at the in-course students' network. Figure 1 describes the social network of the course, as well as students' satisfaction with group work. The nodes' labels represent each individual student, and their size represents the students' scores on the satisfaction with group work scale. The nodes' colors represent the qualitative codes; a white color represents an entirely positive attitude, a gray color represents non-positive attitudes, and a black color represents no data. The arrows' thickness represents the frequency of the interactions. The arrows' colors represent students' groups; same-colored arrows represent the same group, and black arrows represent connections outside of the group. The groups can also be identified by their respective letter label. Finally, the arrowheads represent the direction of the connection. Two-headed arrows represent a bidirectional relationship, and one-headed arrows mean that one of the students mentioned a connection with the other, but not vice versa. The arrow lengths are arbitrary and were selected to enhance the network's presentation.

Figure 1. Satisfaction with group work in the course network based on the qualitative codes and the scale scores



Note: Node size represents the satisfaction with group work in this course score. The arrows represent the direction and the frequency of the interactions (thicker arrows represent more frequent interactions). The same color arrows represent the same workgroup.

In general, we can see that most interactions among students occurred within their groups, and that cross-group connections were minimal. This strengthens the findings that the students felt more comfortable consulting with their group members about the course content instead of other students and even with their friends outside the course. Within each group, most connections were bidirectional, but varied in intensity.

There seems to be an agreement between the open-ended and scale responses, where white nodes (positive open-ended responses) tend to be larger (high scale scores), and vice versa. In four groups, all members agreed that their experience was positive. Examining the interactions among members of these groups, it seems like all of the interactions were bidirectional, and all of the students interacted with all of the other members of their groups, though the frequency of the interactions varied. For example, the interactions in groups C, E, and G were more frequent in comparison with the interactions in group B.

However, for the other groups, there were some disagreements that followed different patterns. In group A, three students were satisfied with their work, both according to their quantitative scores and qualitative analysis, but one student (A7) was not. They were one of the students who mentioned having to work harder to cover for a freeloader, an issue not mentioned by the other group members. In this group, all members reported interacting frequently with student A12, but student A12 did not report

interacting as much with the others. This is the student that struggled to communicate via Zoom, limiting their self-perceived contribution to the group's effort. One may speculate that student A7 agrees that student A12 could have contributed more, affecting their satisfaction with the group. In this group, some of the negative experiences were amplified due to the use of remote communication caused by the pandemic, though the freeloading problem might have existed if the group had met in person, as well.

A similar pattern was observed in group K, but the difficulty was attributed to a different problem; student K21 agreed that the group worked well, but felt that a group setting does not support their personal learning. In this group, all of the students interacted with each other quite frequently. Perhaps the interactions were too frequent for student K21. In any case, it seems like the issue was indeed specific to one student, rather than affecting the group as a whole. Further, the negative experience of that student can be attributed to the use of CL in general, regardless of the mode or the effects of COVID-19.

On the other hand, students in group F all had negative attitudes toward group work in this class, as seen both qualitatively and quantitatively, with the exception of student F38 who did not describe their experience in the open response questions but had high scores on the Likert scale. Although it is impossible to know what student F38's experience was like, we can examine their group members' experiences. Interestingly, all of them agreed that their group worked well overall, but each described a different problem. Student F9 simply prefers to work alone, student F29 complained about a freeloader, and student F35 got frustrated with conflicting answers to their questions within the group. Student F29 reported having more frequent communications with the other group members than vice versa, potentially reflecting their higher expectations of involvement. Even though most students were at least somewhat dissatisfied with their group, the issues seemed to be individual and not the result of dysfunctional group dynamics. Moreover, the issues seem to be relevant to CL at large and were not attributed to the constraints caused by the pandemic.

For the final example, let us turn to group J. While overall there seems to be some agreement between the scale scores and the open-ended responses, this was not the case for this group. Particularly, students J10 and J30 had very low scores on the scale (1.6 and 1.4 out of 5, respectively), but both said that the group was helpful, supportive, and productive. Indeed, the connections among the students indicate that the relationships among the group members were bidirectional. It is possible that the students did not feel comfortable being honest about their experience in the open-ended responses, especially given that the survey was not anonymous. Perhaps the Likert-style items were perceived as less personal and more conducive to honest responses. Another possibility is that since the order of the response options was non-traditional (left-hand responses indicated agreement with the statements), the students endorsed low categories when they intended to endorse high categories.

To answer the second research question, while some groups had unanimously good experiences, many groups had one or two students who disagreed with the generally positive impression. Negative experiences among all group members were less common; rather, the dissatisfied students each described their own unique challenges. In addition, while most of these challenges (personal preferences, having to cover for a freeloader) probably would have existed when using CL regardless of the context, some of the interactions among students were made worse because of technical issues related to the online format adopted due to COVID-19.

DISCUSSION

CL presents students with many challenges that affect their learning experience. Some of these challenges may have been made more difficult due to the COVID-19 pandemic. The current study used a combination of text-based, numerical, and network data to understand the specific challenges faced by students engaging in CL during the pandemic, with a specific emphasis on intra-group trends. The findings suggest that the students were overall satisfied with CL in this course, in spite of some academic, social, and technological challenges. Several issues were identified within the groups, but they were generally specific to one student. The use of online communication due to the pandemic possibly contributed to some friction within groups (e.g., by making communication more difficult due to technical issues), but most of the challenges resemble those mentioned in traditional CL contexts (Nokes-Malach, Richey, and Gadgil 2015).

Students' experiences were divided into academic, social, and technological. Academically, group work saved students effort by sharing the workload, helped them perform better on the assignments by listening to others' points of view, and kept them more involved with the course material. This reflects some cognitive and social mechanisms that explain how CL enhances learning, such as increasing working memory resources, having multiple representations of knowledge, and increasing engagement (Nokes-Malach, Richey, and Gadgil 2015). Socially, being a part of a small, cohesive group helped many students feel more comfortable sharing their difficulties and asking questions, and eventually expanding their social connections outside of class. Indeed, some existing studies show that CL enhances social relationships outside of class (Mamas 2018). On the other hand, many students mentioned issues related to social loafing, similar to the problems mentioned by Nokes-Malach, Richey, and Gadgil (2015). Students also had some unique issues rarely mentioned in previous studies, such as getting conflicting information from different sources and having existing social connections distract them from the assignment at hand.

While many of the findings are relevant to CL at large, some are more specific to the times of COVID-19. On the one hand, CL provided an opportunity to spend time with friends and to get to know new people when social interactions outside of class were limited (e.g., Wang et al. 2020). On the other hand, the necessity to communicate via Zoom introduced some problems that are less relevant to CL in person: students who experienced internet connection issues or were distracted because they did not have a quiet, well-lit working environment found it difficult to engage with CL, hurting their learning and intensifying other students' perception of social loafing. In addition to these challenges, having to constantly use Zoom, be seen on camera but not being able to get all non-verbal communication cues from others was very difficult for students. Indeed, existing studies suggest that using videoconferencing platforms may cause unpleasant feelings among college students (Oducado et al. 2022) in a way that impacts their well-being and mental health (Mamtani et al. 2022; Schlesselman, Cain, and DiVall 2020). Experiencing "Zoom fatigue" made it difficult to stay engaged and might have caused some social conflicts. Finally, even though engaging with group work helped bring students closer together, their interaction was limited relative to times when in-person group work is possible.

The current study also introduced the idea of exploring students' experiences in the context of their group members. This approach revealed some notable intra-group patterns. Some groups were unanimous in their positive attitudes toward CL; the students in these groups all interacted with each other, though the frequency of these interactions varied. Other groups had one or two students who had negative attitudes. However, the groups varied in why the dissenting students were not happy with their

groups; even in the one group where most students had some negative experiences, they were attributed to different reasons, and not to an overall problematic group. In some of the cases, the combination of textual, Likert-style, and network data allowed for some speculations related to the group dynamics. For example, for some students, the frequency of communication among the group members did not match their expectations. One may surmise that different levels of intensity work for different students, so CL could be more beneficial if the group members generally agree on the level of involvement expected. Overall, looking at group-level differences exposed the variety of experiences and how they could be framed differently, depending on the other group members' experiences. This approach could enhance future explorations of CL by identifying dysfunctional groups or students who would have benefited from CL at different levels of intensity.

This study revealed some important aspects of CL and the opportunities and challenges it offers in times of crisis. However, it has several limitations. Since the study was conducted in a single course, it has a relatively small and homogenous sample for quantitative studies, but it provided a rich source of qualitative information. As the effects of COVID-19 are diminishing, it is unlikely that the study will be replicated during a time of such a global crisis; however, it might be replicated in online settings not during a pandemic, and the intra-group approach could also be applied to in-person courses to see if it leads to similar conclusions. Moreover, the results might not generalize to other contexts where the groups were not self-selected by students and remained constant throughout the semester. This has likely affected the results by contributing to the students' positive attitudes and to the sense of being supported socially and academically.

In addition, this study's limited scope did not allow for exploring intra-group interactions' in relation to students' course achievement or other outcomes of interest. This is crucial in understanding whether intra-group patterns of attitudes contribute to these outcomes beyond individual-level attitudes. Finally, it was not possible to explore students' experiences at the individual and intra-group level by demographics due to the risk of identifying the students. As some demographic groups are especially vulnerable to COVID-related challenges (e.g., Fauville et al. 2021; Salim et al. 2022) as well as the challenges of CL and online learning (e.g., Frei-Landau and Avidov-Ungar 2022; Rizvi, Rienties, and Khoja 2019), this step could greatly enhance future studies' findings and should be pursued in the future.

In spite of its limitations, the study has several important implications for research and teaching practice. For researchers, the findings enhance our understanding of how CL can help students learn, particularly during a global crisis that limits interpersonal interactions. As the findings show that students' attitudes towards CL in this course were positive, unlike some other studies, this implies that some context-specific elements affect students' attitudes, and they can be explored further. Methodologically, the main contribution of this study is the demonstration of an intra-group approach to CL research. It shows that applying this approach can reveal more about how students worked together and what may have caused negative attitudes, offering new opportunities for future research (e.g., studying whether some types of intra-group interactions can predict course achievement).

For teachers, this study highlights the importance of CL and its contribution to students' learning and social connectedness. Therefore, it is recommended that CL pedagogies are incorporated in similar higher education courses. However, the intra-group results yielded some conclusions related to the dose of CL. It seems like negative experiences are not related to the frequency of students' engagement, but rather to diverging expectations in terms of time commitment. So, it might be helpful

to encourage students to clarify these expectations in advance and to consider them when creating the groups. Additionally, teachers should pay attention to intra-group issues that occur throughout the semester, perhaps by using weekly surveys. In the current course, the instructor could have identified freeloaders or addressed the technical difficulties early, preventing some of the negative experiences expressed by the students.

Finally, while the aforementioned implications are relevant to any context, several more specific recommendations can be made. As the social benefits of CL are more evident when students' communication is limited, teachers should especially consider using CL pedagogies in such situations. These include potential future disasters that prevent students from meeting in person, but also more benign situations like online learning settings where students work from different locations. In addition, teachers in online settings should pay special attention to issues such as Zoom fatigue and technical difficulties and attempt to address them in advance (e.g., by using recorded lectures in addition to the Zoom ones or recommending learning resources provided by the institution).

In summary, the current study on students' attitudes toward CL revealed some benefits and issues with CL, and showed how having to deal with virtual learning enhanced some of the challenges on the one hand, but made CL more meaningful for students on the other. It also demonstrates the intra-group approach to CL research and how it can lead to richer descriptions of students' experiences. The study suggests that CL could help address students' social needs, especially during a global crisis, but raises some important problems that could potentially be mitigated by the instructor. Doing so may help students have more positive learning experiences, engage more with CL, and have a deeper understanding of what they learned.

ACKNOWLEDGMENTS

I thank my students for generously sharing their experiences, and Katrina Borowiec and Haylea Hubacz for their helpful suggestions when conceptualizing this study. I also thank the editors and two anonymous reviewers for their insightful comments.

AUTHOR BIOGRAPHY

Ella Anghel, MA, is a PhD candidate in the Department of Measurement, Evaluation, Statistics, and Assessment, at the Lynch School of Education and Human Development, Boston College (USA). Her work focuses on technology-enhanced education.

ETHICS

Research was approved through the Boston College ethical review processes (IRB #21.274.01E).

REFERENCES

Anghel, Ella. 2022. "Let's Do this Together: Do the Quantity and the Quality of Collaborative Learning Predict Achievement among College Students?" *Active Learning in Higher Education*. https://doi.org/10.1177/14697874221120783.

Bandura, Albert. 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice Hall.

Bastian, Mathieu, Sebastien Heymann, and Mathieu Jacomy. 2009. "Gephi: An Open Source Software for Exploring and Manipulating Networks." In *Proceedings of the International AAAI Conference on Web and Social Media* 3 (1): 361–62.

Burdett, Jane, and Brianne Hastie. 2009. "Predicting Satisfaction with Group Work Assignments." *Journal of University Teaching & Learning Practice* 6 (1): 70–81. https://doi.org/10.53761/1.6.1.7.

Capar, Gulfer, and Kamuran Tarim. 2015. "Efficacy of the Cooperative Learning Method on Mathematics Achievement and Attitude: A Meta-analysis Research." *Educational Sciences: Theory and Practice* 15 (2): 553–59. https://doi.org/10.12738/estp.2015.2.2098.

Cabrera, Alberto F., Jennifer L. Crissman, Elena M. Bernal, Amaury Nora, Patrick T. Terenzini, and Ernest T. Pascarella. 2002. "Collaborative Learning: Its Impact on College Students' Development and Diversity." *Journal of College Student Development* 43 (1): 20–34.

Congleton, Adam R., and Suparna Rajaram. 2011. "The Influence of Learning Methods on Collaboration: Prior Repeated Retrieval Enhances Retrieval Organization, Abolishes Collaborative Inhibition, and Promotes Post-collaborative Memory." *Journal of Experimental Psychology: General* 140 (4): 535–51. https://doi.org/10.1037/a0024308.

Fauville, Geraldine, Mufan Luo, Anna Carolina Muller Queiroz, Jeremy N. Bailenson, and Jeff Hancock. 2021. "Nonverbal Mechanisms Predict Zoom Fatigue and Explain Why Women Experience Higher Levels than Men." *Available at SSRN 3820035*. https://doi.org/10.2139/ssrn.3820035.

Frei-Landau, Rivi, and Orit Avidov-Ungar. 2022. "Educational Equity amidst COVID-19: Exploring the Online Learning Challenges of Bedouin and Jewish Female Preservice Teachers in Israel." *Teaching and Teacher Education* 111: 103623. https://doi.org/10.1016/j.tate.2021.103623.

Gemmel, Philipp M., McKenna K. Goetz, Nicole M. James, Kate A. Jesse, and Britni J. Ratliff. 2020. "Collaborative Learning in Chemistry: Impact of COVID-19." *Journal of Chemical Education* 97 (9): 2899–904. https://doi.org/10.1021/acs.jchemed.0c00713.

Giel, Lisenne I.S., Gera Noordzij, Lisette Wijnia, Liesbeth Noordegraaf-Eelens, and Semiha Denktaş. 2021. "When Birds of the Same Feather Fly Together: The Impact of Achievement Goal Compatibility in Collaborative Learning." *Educational Psychology* 41 (1): 79–98. https://doi.org/10.1080/01443410.2020.1787352.

Hodges, Linda C. 2018. "Contemporary Issues in Group Learning in Undergraduate Science Classrooms: A Perspective from Student Engagement." *CBE—Life Sciences Education* 17 (2): es3.

Jeong, Heisawn, Cindy E. Hmelo-Silver, and Kihyun Jo. 2019. "Ten Years of Computer-Supported Collaborative Learning: A Meta-Analysis of CSCL in STEM Education During 2005–2014." *Educational Research Review* 28: 100284. https://doi.org/10.1016/j.edurev.2019.100284.

Karantzas, Gery C., Michelle R. Avery, Susie Macfarlane, Alexander Mussap, Gregory Tooley, Zoe Hazelwood, and Julie Fitness. 2013. "Enhancing Critical Analysis and Problem-solving Skills in Undergraduate Psychology: An Evaluation of a Collaborative Learning and Problem-based Learning Approach." *Australian Journal of Psychology* 65 (1): 38–45. https://doi.org/10.1111/ajpy.12009.

Khosa, Deep K., and Simone E. Volet. 2014. "Productive Group Engagement in Cognitive Activity and Metacognitive Regulation during Collaborative Learning: Can It Explain Differences in Students' Conceptual Understanding?" *Metacognition and Learning* 9 (3): 287–307. https://doi.org/10.1007/s11409-014-9117-z.

Kirschner, Femke, Fred Paas, and Paul A. Kirschner. 2011. "Task Complexity as a Driver for Collaborative Learning Efficiency: The Collective Working-Memory Effect." *Applied Cognitive Psychology* 25 (4): 615–24. https://doi.org/10.1002/acp.1730.

Ku, Heng-Yu, Hung Wei Tseng, and Chatchada Akarasriworn. 2013. "Collaboration Factors, Teamwork Satisfaction, and Student Attitudes toward Online Collaborative Learning." *Computers in Human Behavior* 29 (3): 922–29. https://doi.org/10.1016/j.chb.2012.12.019.

Laal, Marjan, and Mozhgan Laal. 2012. "Collaborative Learning: What Is it?" *Procedia-Social and Behavioral Sciences* 31: 491–95. https://doi.org/10.1016/j.sbspro.2011.12.092.

Lei, Man, and Jane Medwell. 2021. "Impact of the COVID-19 Pandemic on Student Teachers: How the Shift to Online Collaborative Learning Affects Student Teachers' Learning and Future Teaching in a Chinese Context." *Asia Pacific Education Review* 22 (2): 169–79. https://doi.org/10.1007/s12564-021-09686-w.

Ludlum, Marty, Michael Conklin, and Andrew Tiger. 2021. "Group Projects in Higher Education: How Demographic Factors Affect Student Perceptions of Grading, Leadership Roles, Assessment, and Applicability." *Journal of Higher Education Theory & Practice* 21 (1).

Machemer, Patricia L., and Pat Crawford. 2007. "Student Perceptions of Active Learning in a Large Cross-Disciplinary Classroom." *Active Learning in Higher Education* 8 (1): 9–30. https://doi.org/10.1177/1469787407074008.

Mamas, Christoforos. 2018. "Exploring Peer Relationships, Friendships and Group Work Dynamics in Higher Education: Applying Social Network Analysis." *Journal of Further and Higher Education* 42 (5): 662–77. https://doi.org/10.1080/0309877x.2017.1302568.

Mamtani, Harkishan, Ruta Karaliuniene, Renato de Filippis, and Sachin Nagendrappa. 2022. "Impact of Videoconferencing Applications on Mental Health." *BJPsych International* 19 (1). https://doi.org/10.1192/bji.2021.40.

Marks, Melanie Beth, and Abigail H. O'Connor. 2013. "Understanding Students' Attitudes about Group Work: What Does this Suggest for Instructors of Business?" *Journal of Education for Business* 88 (3): 147–58.

Nokes-Malach, Timothy J., Michelle L. Meade, and Daniel G. Morrow. 2012. "The Effect of Expertise on Collaborative Problem Solving." *Thinking & Reasoning* 18 (1): 32–58. https://doi.org/10.1080/13546783.2011.642206.

Nokes-Malach, Timothy J., J. Elizabeth Richey, and Soniya Gadgil. 2015. "When Is It Better to Learn Together? Insights from Research on Collaborative Learning." *Educational Psychology Review* 27 (4): 645–56. https://doi.org/10.1007/s10648-015-9312-8.

Oducado, Ryan Michael F., Maria Teresa R. Fajardo, Geneveve M. Parreño-Lachica, Jestoni D. Maniago, Paulo Martin B. Villanueva, Ma Asuncion Christine V. Dequilla, Hilda C. Montaño, and Emily E. Robite. 2022. "Is Videoconference 'Zoom' Fatigue Real among Nursing Students?" *Journal of Loss and Trauma* 27 (5): 490–92. https://doi.org/10.1080/15325024.2021.1950987.

Omodan, Bunmi Isaiah, and Olugbenga A. Ige. 2021. "Sustaining Collaborative Learning among University Students in the Wake of COVID-19: The Perspective of Online Community Project." *International Journal of Learning, Teaching and Educational Research* 20 (1): 356–71. https://doi.org/10.26803/ijlter.20.1.20.

Rajaram, Suparna, and Luciane P. Pereira-Pasarin. 2010. "Collaborative Memory: Cognitive Research and Theory." *Perspectives on Psychological Science* 5 (6): 649–63. https://doi.org/10.1177/1745691610388763.

Rizvi, Saman, Bart Rienties, and Shakeel Ahmed Khoja. 2019. "The Role of Demographics in Online Learning; A Decision Tree Based Approach." *Computers & Education* 137: 32–47. https://doi.org/10.1016/j.compedu.2019.04.001.

Salim, Jonathan, Sutiono Tandy, Jannatin Nisa Arnindita, Jacobus Jeno Wibisono, Moses Rizky Haryanto, and Maria Georgina Wibisono. 2022. "Zoom Fatigue and Its Risk Factors in Online Learning during the COVID-19 Pandemic." *Medical Journal of Indonesia* 31 (1): 13–19. https://doi.org/10.13181/mji.oa.225703.

Samara, Omar, and Anthony Monzon. 2021. "Zoom Burnout amidst a Pandemic: Perspective from a Medical Student and Learner." *Therapeutic Advances in Infectious Disease* 8: 20499361211026717. https://doi.org/10.1177/20499361211026717.

Sangin, Mirweis, Gaëlle Molinari, Marc-Antoine Nüssli, and Pierre Dillenbourg. 2011. "Facilitating Peer Knowledge Modeling: Effects of a Knowledge Awareness Tool on Collaborative Learning Outcomes and Processes." *Computers in Human Behavior* 27 (3): 1059–67. https://doi.org/10.1016/j.chb.2010.05.032.

Schlesselman, Lauren S., Jeff Cain, and Margarita DiVall. 2020. "Improving and Restoring the Well-being and Resilience of Pharmacy Students during a Pandemic." *American Journal of Pharmaceutical Education* 84 (6). https://doi.org/10.5688/ajpe8144.

Simms, Ashley, and Tommy Nichols. 2014. "Social Loafing: A Review of the Literature." *Journal of Management* 15 (1): 58–67.

Skinner, Kay Lesley, Sarah J. Hyde, Kerstin McPherson, and Maree D. Simpson. 2016. "Improving Students' Interpersonal Skills through Experiential Small Group Learning." *Journal of Learning Design* 9 (1): 21–36. https://doi.org/10.5204/jld.v9i1.232.

So, Hyo-Jeong, and Thomas A. Brush. 2008. "Student Perceptions of Collaborative Learning, Social Presence and Satisfaction in a Blended Learning Environment: Relationships and Critical Factors." *Computers & Education* 51 (1): 318–36. https://doi.org/10.1016/j.compedu.2007.05.009.

Sung, Yao-Ting, Je-Ming Yang, and Han-Yueh Lee. 2017. "The Effects of Mobile-Computer-Supported Collaborative Learning: Meta-analysis and Critical Synthesis." *Review of Educational Research* 87 (4): 768–805. https://doi.org/10.3102/0034654317704307.

Sweeney, Arthur, Scott Weaven, and Carmel Herington. 2008. "Multicultural Influences on Group Learning: A Qualitative Higher Education Study." *Assessment & Evaluation in Higher Education* 33 (2): 119–32. https://doi.org/10.1080/02602930601125665.

Talan, Tarik. 2021. "The Effect of Computer-supported Collaborative Learning on Academic Achievement: A Meta-analysis Study." *International Journal of Education in Mathematics, Science, and Technology* 9 (3): 426–48. https://doi.org/10.46328/ijemst.1243.

Voiklis, John, and James E. Corter. 2012. "Conventional Wisdom: Negotiating Conventions of Reference Enhances Category Learning." *Cognitive Science* 36 (4): 607–34. https://doi.org/10.1111/j.1551-6709.2011.01230.x.

Wang, Xiaomei, Sudeep Hegde, Changwon Son, Bruce Keller, Alec Smith, and Farzan Sasangohar. 2020. "Investigating Mental Health of US College Students during the COVID-19 Pandemic: Cross-sectional Survey Study." *Journal of Medical Internet Research* 22 (9): e22817. https://doi.org/10.2196/22817.

Zhu, Chang. 2012. "Student Satisfaction, Performance, and Knowledge Construction in Online Collaborative Learning." *Journal of Educational Technology & Society* 15 (1): 127–36.

Appendix A: The Open-Ended Questions Used in This Study

- How did you form your research group? E.g., knew each other before, at random . . .
- How do you feel about group work in this class and your interactions with your research group? (helpful, productive, frustrating, etc.)
- Did you experience any challenges in group work related to COVID-19 (using zoom, social distancing, etc.)?
- Did you experience these or other COVID-19-related challenges when learning individually?
- Is there anything else you'd like to share about your experience in this class?


Copyright for the content of articles published in *Teaching & Learning Inquiry* resides with the authors, and copyright for the publication layout resides with the journal. These copyright holders have agreed that this article should be available on open access under a Creative Commons Attribution License 4.0 International (https://creativecommons.org/licenses/by-nc/4.0/). The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited, and to cite *Teaching & Learning Inquiry* as the original place of publication. Readers are free to share these materials—as long as appropriate credit is given, a link to the license is provided, and any changes are indicated.