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ARTICLE

Collaborative Learning: Students' Perspectives on How Learning Happens

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Abstract

Collaborative learning (CL), a core component of inquiry-based learning approaches, aims to support students' development of key skills (e.g., working in multidisciplinary teams). To design effective CL activities, we need to understand students' perceptions about CL. However, few studies have examined students' understandings of CL. This qualitative study aimed to address this gap by analyzing participants' constructions of their CL experiences. Focus group data (14 first- and 14 fourth-year dental student volunteers) were analyzed by an inductive thematic analysis strategy. The findings explained students' perspectives of key factors for facilitating positive learning within an inquiry-based CL context, namely having a "right" mix of students and facilitating balanced participation and interactions, especially questioning, explaining, and managing knowledge conflicts and understanding their thinking processes when learning.

Keywords: collaborative learning, inquiry-based learning, students' perspectives

Introduction

Professional education must adequately prepare graduates to practice in a continually changing context; for example, graduates will increasingly work in cross-disciplinary teams and with people from diverse backgrounds. Therefore, an adequate professional education should "actively engage preservice [professionals] in opportunities for knowledge seeking, for problem solving, and for the collaborating necessary for effective practice" (Evensen & Hmelo-Silver, 2000, p. 1). Accordingly, to provide students with opportunities to develop future work skills, collaborative learning (CL), a core component of inquiry-based learning approaches, is often used in professions education. CL has advantages over other learning methods, such as sharing learning experiences; learning information-searching skills; having peer support; learning presentation skills; having authentic opportunities; providing opportunities for cognitive conflict within a CL team, which encourages learning; and simulating a real work environment (Barrows & Tamblyn, 1980; DeGrave, Boshuizen, & Schmidt, 1996; Johnson & Johnson, 2009).

However, CL contexts are complex and affected by various factors. For example, CL processes and outcomes are influenced by a range of social, psychological, and personal factors. Students' personal relationships with each other directly affect the quality of interpersonal interactions during group activities and the success of their collaboration (Skinner et al., 2012). It has been shown that students' personality and preferences impact the learning environment, with levels of engagement varying depending on perceived reactions of colleagues (Cockrell, Caplow, & Donaldson, 2000). Additionally, a range of culturally related factors can explain variations in students' involvement in a CL context (Jin, 2012; Melles, 2004; Remedios, Clarke, & Hawthorne, 2008). While

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it is recognized that knowledge conflicts are important for stimulating students' learning (DeGrave et al., 1996; Johnson & Johnson, 2009; Littleton & Häkkinen, 1999), it has been reported that students did not manage these conflicts as expected and spent less time discussing them (Visschers-Pleijers, Dolmans, de Leng, Wolfhagen, & van der Vleuten, 2006). As a result, these factors have a variable impact on learning outcomes (e.g., in either negative or positive ways), dependent on the CL context (Rich, Keim, & Shuler, 2005).

Therefore, to ensure that we optimize CL for students, we must understand students' perceptions about their CL contexts and the practical experience of CL and their effects on students' learning (Biggs & Tang, 2011; Till, 2005). This is important, as we know that students' learning outcomes are influenced by their perceptions of their learning context (Lizzio, Wilson, & Simons, 2002; Prosser & Trigwell, 1999; Vermetten, Vermunt, & Lodewijks, 2002). However, a recent comprehensive systematic review about medical and dental students' perceptions and experiences of CL within various inquiry-based learning contexts demonstrated that there were few studies exploring students' perspectives of elements necessary for effective CL (Almajed et al., 2014). Rather, the majority of studies investigated students' perceptions of advantages and disadvantages of CL and evaluations of courses and learning outcomes. Furthermore, the methodological and reporting qualities of many studies were limited. For example, lack of a clear methodological approach and underrepresentation of students' voices were identified. In addition, the systematic review (Almajed et al., 2014) identified gaps in our knowledge about students' perceptions of learning in groups. Specifically, there was a lack of evidence regarding students' understanding of what CL involves, students' perceptions about when learning happens, what enables their learning when learning collaboratively, their understandings and management of knowledge conflicts, and their goals for learning in CL contexts.

As a result, it was necessary to conduct a focused and rigorous study to inform our knowledge base about students' perceptions of CL. Therefore, this qualitative study aimed to explore students' understandings of the core elements necessary for learning collaboratively. Specifically, this study aimed to explore students'

- perceptions about when group learning works (based on their current experiences of when learning occurred and how);
- understanding of what learning together involves;
- goals for group learning; and
- understandings of the role of conflicting knowledge in their learning and how they manage such disagreements.

Findings from this study should inform curriculum planning, design of learning activities, induction of students to learning in CL contexts, and tutor training activities with the aim of improving CL experiences in the education of dental and health professionals.

Methodology

To address these aims adequately we used a qualitative study, drawing on a constructionist interpretive methodological approach (Merriam, 2009). An interpretive approach was appropriate to investigate participants' constructed understandings of their current CL environment through asking participants open-ended questions that encouraged them to explain the meaning they had developed about their CL context (Creswell, 2003). In turn, patterns of meanings from participants' constructions of their experiences in CL were generated (Creswell, 2003; Merriam, 2009). The authors then further interpreted students' understandings using the theoretical underpinnings of CL to extend our knowledge and the current qualitative evidence in this area (Braun & Clarke, 2006; Merriam, 2009). The current study design also aimed to address methodological issues identified in the systematic review (Almajed et al., 2014) by following recommended approaches for qualitative educational studies (O'Brien, Harris, Beckman, Reed, & Cook, 2014; The Joanna Briggs Institute, 2011).

Acknowledgment of the researcher's theoretical and cultural position and any potential bias in relation to the research topic is considered an important element for rigorous qualitative research methods (The Joanna Briggs Institute, 2011). The primary researcher's (Author 1) interest in exploring complex CL environments developed from completing postgraduate dental study in a CL setting. Following this experience, areas for further investigation included students' perceptions about CL in terms of their learning management, factors affecting their learning processes, and their learning goals. A need to investigate these areas was reinforced after conducting a comprehensive systematic review (Almajed et al., 2014), which showed that more focused studies are needed to explore students' perceptions through qualitative research that yields meaningful, rich data.

Ethical Considerations: Participant Recruitment and Data Management

Ethics approval (HS-2013-001) for the study was obtained from the institution's Human Research Ethics Committee. The ethical considerations in terms of student participation in this research involved protecting students from any breaches of their privacy and also protecting their personal

and academic well-being. Author 1 had no established relationship between the undergraduate dental students/participants prior to the study and was not involved in any teaching or assessment processes. Therefore, he conducted the participant recruitment and consent processes and data collection, and de-identified all the related documents and subsequent data for the study. In a class, Author 4 introduced students to Author 1 as an international PhD student who would not be involved in their teaching or assessment. As a result, they could talk openly to him during focus groups (FGs). Subsequently Author 4 left the class, and Author 1 informed students about the study. To disseminate the invitation to participate in the study to students who did not attend the class, an e-mail from Author 1 was sent using the dental school's e-mail distribution service. Participants were invited to respond on a voluntary basis. Information sheets and consent forms were provided to support the explanation, and students' questions were addressed. The remaining authors and other staff involved in teaching and assessment for dental students during the study were not involved in the collection or recording of consent forms or subsequent data collection and management. The organization and running of the focus groups were undertaken solely by Author 1. Focus groups were arranged at times suitable for students and in locations away from staff offices.

The study documents and data were de-identified by Author 1 by removing any reference to student and staff identities. This process included giving each participant a code to de-identify transcripts, such as $F_4$1, $F_4$2, $M_4$1 (F = female, M = male; the subscript number = the year level). All data analyses and reviewing by the remaining authors (research supervisors for Author 1) were performed after de-identification. The data were not accessible to any other staff or students who were not involved in the study. All data were handled confidentially and were securely stored, without any identifying material, in a locked cabinet that was not accessible to academic staff involved in any teaching or assessment processes.

Context

This study involved students from the five-year Bachelor of Dental Surgery (BDS) program at an Australian dental school. Students in the BDS program are a mix of school leavers (i.e., students entering directly from secondary/high school) or university graduates (i.e., students who had undertaken or completed tertiary studies) and included domestic and international (temporary resident) students. The curriculum involves small and large group learning within a single multidisciplinary integrated stream. Case-based learning, encompassing a range of small group (5–7 students) CL contexts, organizes students' learning (Kaidonis et al., 2013). First- to fourth-year students analyze professional scenarios, involving research, integration, and application of concepts from other learning activities, over 2- to 4-week blocks. Students begin each case working in small groups (5–7 students) within a whole class setting with staff facilitating. This process concludes with students developing research questions that link with key observations about the patient case. Subsequently, students meet in their small groups to review their research questions and integrate their research in the context of the patient or situation. In the first and second years only, tutors facilitate these small group meetings (two one-hour sessions/cases). In the first session, students discuss their initial research plans, including clarifying key areas to investigate, potential resources, and how the group members will manage their research. The second small group session involves students discussing their research findings, including reviewing key concepts and relating these to the patient's situation. The other key outcome of this session is to collaboratively work on their groups' summary of their research to be discussed at the subsequent whole class review of the case. Various classes (e.g., interactive lectures, learning labs, clinic activities, and tutorials) are provided to support students' research. The case analysis cycle concludes with groups submitting a summary of their research. These summaries form the basis of the review of their learning in the final session with the whole class (two hours). Students again work in their small groups within this whole class setting and discuss the core outcomes from their research and/or respond to staff-provided questions that require application of their learning to the patient situation. Staff facilitate this review and application phase.

To support students' development of CL skills, their participation in the small group tutorials is assessed over the four semesters of the first and second years. Specific criteria and standards (i.e., knowledge, reasoning skills, and use of evidence; professionalism; and interpersonal, communication, and learning skills) are used. The initial six weeks of the first and second years are formatively assessed. At the end of this initial period, students use the criteria and standards to complete a self-assessment of their performance. The students' self-assessments are discussed in the small group tutorial, supported by group and individual feedback from the tutor. Tutors provide feedback during the semester and a summative assessment (nongraded pass) at the end of each semester.

Participants, Data Collection, and Analysis

A purposive sampling approach was used to achieve maximum variation in the selection of the study participants (Coyne, 1997). All first- and fourth-year students were invited to participate. First-year students were selected, as this was the first experience of CL in a higher education environment for many. Therefore, it was considered important to understand

this group of students' experiences of a CL context at this early stage of their learning experiences in higher education. Fourth-year students were selected because they were the first cohort who experienced the revised BDS curriculum when it was implemented at the School of Dentistry in 2010. Their insights were considered important, as they provided the longest experience of the CL context in the revised BDS across all current cohorts. Details related to age, gender, and residence of first- and fourth-year cohorts are presented in Table 1.

A self-selection approach was used for student recruitment. No exclusion criteria were set, as the sampling process aimed for a wide range of students' experiences. Fourteen first-year and 14 fourth-year students participated in FGs, with further data collection by e-mail. Details related to age, gender, and residence of first- and fourth-year participants are presented in Table 2. These ratios are similar to their cohorts, with slightly more international students participating from the first-year group. Both school leavers and students with previous tertiary experience were equally represented in the participating first- and fourth-year students. By comparison with their student cohorts, there were fewer males from both year levels who participated in the FGs, while similar numbers of domestic and international students were involved.

The FGs were year specific, with a total of nine FGs conducted; five first-year FGs and four FGs with fourth-year students. Each FG was approximately one hour and consisted of two to four participants (Morgan, 1997; Vaughn, Schumm, & Sinagub, 1996). Factors such as the amount of collected data, available resources, and practical issues of finding convenient times for the participants limited the number of FGs for each cohort in this study. Three to four FGs were considered optimum for each cohort in terms of the resultant data size and the available resources. Running small FGs assisted in managing issues of participants' availability, enabled all participants to express their opinions while minimizing problems of interruptions with larger numbers of participants, addressed issues of clarity of recordings (Millward, 2012), and enabled participants to feel more comfortable sharing their ideas (Onwuegbuzie, Dickinson, Leech, & Zoran, 2009).

The authors developed the content of the focus group questions from the findings of the initial systematic review (Almajed et al., 2014). Author 1 then piloted these questions with a small test group (five volunteer dental postgraduates). On the basis of this group's feedback and discussion with the other authors, the questions were refined into the initial set of FG questions. These open-ended questions included "What made learning in a group work?," "What resulted in learning?," "How important is group learning?," and "How would you improve your experience of learning in groups." During the data collection and concurrent analysis, the authors discussed and then further modified the questions as data were obtained (Morse, Barrett, Mayan, Olson, & Spiers, 2002). The main changes related to the aim of investigating students' understanding of what learning together involves. In the initial FGs, students did not discuss their learning processes; therefore, the questions were modified to try to elicit these data. For example, to direct students toward talking about learning processes, an additional question was added: "Can you describe what's going on inside your head?" By the last two FGs (eight and nine), the modified questions yielded data on students' CL processes. Therefore, to find out how the participants from FGs 1–7 would respond to the final modified questions and to maintain consistency throughout data collection, follow-up e-mails with the other focus group participants were used. An initial e-mail involved the same question about what's going on inside your head, with follow-up e-mail questions regarding their learning processes indicated by other students. All 10 first-year students responded, and 12 out of 14 fourth-year students responded. In their e-mails students described various learning processes, which provided data to add to what was obtained in FGs 8 and 9.

Each FG was audio-recorded, and the recordings were transcribed by a professional typist. After participants had approved a copy of their own transcript, analysis began with summarizing each de-identified transcript (Krueger & Casey, 2002). Transcripts and field notes were analyzed by Author 1 using NVivo qualitative data software version 10 (© QSR International Pty Ltd.), in consultation with the other authors. An inductive thematic analysis strategy was used (Braun & Clarke, 2006; Merriam, 2009), resulting in identification of emergent ideas with constant comparison to confirm codes and recurrent patterns and themes. The

Table 1. Demographics of the first- and fourth-year student cohorts.

	Year-Level Cohort (F:M Ratio)	Average Age in Years (SD)	Domestic Students: South Australia (%)	Domestic Students: Interstate (%)	International Students (%)
First year	78 (44 F:34 M)	19.6 (3)	15 (19.2%)	39 (50%)	24 (30.8%)
Fourth year	69 (40 F:29 M)	22.4 (2.7)	19 (27.5%)	29 (42.1%)	21 (30.4%)

Table 2. Demographics of the first- and fourth-year participating students.

	Gender: F/M	Average Age in Years (SD)	Domestic Students: South Australia (%)	Domestic Students: Interstate (%)	International Students (%)	Previous Education: School or Tertiary (%)
First year (14)	11 F 3 M	19.6 (1.6)	4 (28.6%)	4 (28.6%)	6 (42.9%)	7 school (50%) 7 tertiary (50%)
Fourth year (14)	12 F 2 M	21.5 (0.7)	2 (14.3%)	7 (50%)	5 (35.7%)	7 school (50%) 7 tertiary (50%)

first step of the analysis was to develop subcodes, which were labels for key ideas that emerged from the transcripts. These were usually based on students' words, such as "same motivation," and "similar personalities." Subsequently, subcodes were grouped into codes, which represented similar concepts and were labeled using students' words (e.g., "The right batch of people") or by the researchers (e.g., *benefits and positive outcomes of conflict*). Finally, the codes were examined for larger patterns, which were identified as themes such as *facilitating factors*. Further, these themes were reinterpreted in relation to the theoretical underpinnings of CL to create final themes (Braun & Clarke, 2006).

Results

Based on the theoretical elements of CL (Dillenbourg, 1999), analysis of FG transcripts generated four main themes:

- context
- group/learning interactions
- group and learning processes
- outcomes

In general, the results of this study showed that students acknowledged how their group learning experiences provided them with key academic and social supports. Apart from a few exceptions, there was a strong similarity in students' responses in both year levels across the main themes.

Theme 1: Context

This theme, representing students' perceptions about the CL context, included three codes: *difference*, *facilitating factors*, and *inhibiting factors*. With respect to *difference*, students perceived that different people with different perspectives, bringing various opinions and inputs to their discussions, were important and a major factor influencing positive outcomes and enriching their experiences.

> I think even our group of 80 we are all from so many different places and there are just so many new cultures and that sort of stuff that having all of these absolutely different opinions is really—like, makes a whole difference to my learning this year in comparison to any other year, because I'm just surrounded by this whole different group of people who [I] never have been. ($F_1$14)

> I think it's very important. Like what I mentioned before, everyone has a different understanding of the things that they can read or understand and it's good to draw from other people's experience and their understanding. ($F_4$11)

Various contextual *facilitating* and *inhibiting factors* affected students' learning. Seven key facilitating factors positively affected students' learning:

- Coherence toward learning: Group members having similar attributes and approaches toward learning in groups.
- Group organization: Having a small and organized group with clear directions and goals;
- Learning preparation: Group members being prepared before group meetings.
- Accountability: Being accountable and encouraged as a result of being part of a group that was working well.
- Relaxed environment. Having a relaxed group environment.
- Relevant topics: Learning about relevant and interesting topics.
- Tutor support: Receiving support from a tutor/leader.

Coherence Toward Learning

Students considered having "the right batch of people" ($M_4$2) was a key factor in the effectiveness of CL. Specifically, having group members with similar approaches toward group work—"common objectives" ($F_4$11) and motivations, being hardworking and enthusiastic, participating and sharing, and having the required "communication" ($F_4$1) skills—were perceived as influencing group performance and subsequent

learning outcomes. Students considered that these similarities would allow the group to work as a united team during CL, which subsequently would improve group dynamics and their learning processes. However, most of the students thought that a similarity in academic levels was not necessary.

> But I think what has to be similar is the attitude towards group learning, that they feel that group learning is important, so everyone must feel that group work is something that they have to do together, that everyone must feel that group meetings is something everyone must participate in, so that is what I feel must be the same kind of—that everyone must agree on that aspect but not in the sense that you must be on the same level when it come[s] to academics or that you must study in the same way together. Like it doesn't matter if someone is a visual learner or someone is a different kind of learner, that is fine, it is just about the attitude towards group work. ($F_1$23)

Group Organization

Participants said that having a small and organized group with clear directions and goals was an important factor for the success of their learning experience in CL.

> When the group is organised, when all the people in the group have the same ideas—not the same ideas but they kind of understand what the aim of the project is and work together really well. ($F_1$19)

Learning Preparation

Students indicated that preparation before group meetings was a key factor for their learning experiences, as this facilitated sharing of information and participation in the group's learning activities.

> For me what makes it successful is when everybody comes prepared. ($M_4$1)

Accountability

Students reported that they experienced a positive and motivating effect due to being counted as a member of a group. The effect of group membership worked as a driving force that increased the students' "sense of responsibility" ($F_1$20) toward their group, and subsequently this increased their motivation toward group work and collaboration.

> If there's five other people that you made this commitment with and they're all accountable to do their share as well and you let them down that's a really big motivating factor to make sure that you do pull your weight and do the extra work. ($F_4$6)

Relaxed Environment

The fifth *facilitating factor* involved having a relaxed group environment in terms of group composition and absence of stress of assessment, thereby enabling learning.

> If it was relaxed they would be fine saying their ideas that they had—it could be something totally out there—but they would still say it whereas if it's an assessed thing I feel like a lot of people, except those who are really confident, will probably just sit back and see what the other people say first. ($F_1$14)

Relevant Topics

The sixth factor expressed by some participants was the belief that having relevant and interesting topics, such as clinical and practical topics, increased motivation for discussion and learning during CL. Topics commonly associated with differences in opinions (e.g., patient management) also facilitated learning. In these situations, learning occurred as group members had to discuss different perspectives and ideas, which provoked them to think.

> I think making the topics more scenario based is really good for learning in groups because it's not something you can just rote-learn and you can kind of cover everything, so I think in the later years now we've got more treatment planning questions which is good because that's a really big area that you can discuss a lot. . . . That's where I learn a lot when it's that understanding conceptual work rather than just theory, theoretical nitty-gritty details. ($F_4$1)

Tutor Support

The final facilitating factor was that support from a leader/tutor/facilitator was necessary. Students expressed the need for someone to provide guidance and knowledge and direct them to the right path. Students frequently used terms suggesting that their view for the role of the tutor was "to direct the discussion" ($F_4$10), "to have read up before" ($F_4$7), "to teach us properly" ($F_1$14), to provide "direct feedback" ($F_1$22), and manage the dominant students and "shut them down" ($M_1$4).

> Yeah, or I mean it even stems down from the quality of the lecturer that we had or the quality of the tutor that we had and whether we thought if we haven't been

> given someone that we can understand or who cared enough to teach us properly we are not really going to care enough to learn this properly. ($F_1$14)

On the other hand, students reported six *inhibiting factors* that negatively affected their learning:

- workload: course requirements and commitments;
- difficult personalities: presence of students whose behaviors were not collaborative;
- limited participation: group members not sharing/participating;
- assessment: being assessed on their participation by a tutor;
- tutor-provided answers: having a tutor give them the answers; and
- competition.

In certain situations, the effect of these negative factors led students to prefer learning individually; they considered learning in groups a waste of time because they lost control of their own learning.

> I find that if the leader is too rigid and inflexible in what they want, so they expect this by a certain time, like no flexibility at all, I find that tends to stress me out a lot because I feel really pressured to get it just right by a certain time. ($F_4$4)

Workload

Due to the perceived course workload, students distributed the work from their CL activities among the group members, thus aiming to finish the requirements in the time given, as it was "a lot more efficient to just split it up rather than do it as a group" ($F_4$2). However, students reported that these arrangements were done at the expense of learning, as the distribution of the task was done primarily to finish the task and hand it in on time.

> Just want to get it done and hand it in. This is really bad but it is not necessarily a learning process where you are trying to learn about everything, it is more of—like, I think a lot of people consider it as something you have to do and hand in. ($F_4$10)

Difficult Personalities

Students recognized that the presence of difficult behaviors or a "forceful person who forces their ideas on the whole group" ($F_4$4) was an inhibiting factor for their learning.

> If it's just like one person who has a dominant voice voicing their opinions it has a tendency of other people I guess just not contributing or not participating as a result. ($M_4$1)

Limited Participation

Students indicated that a lack of participation negatively affected their learning. They also noted the presence of quiet or "slack" students who are "not pulling their weight" ($F_4$2) in terms of participating in discussion and sharing of information and/or who came to the group meeting without preparation.

> I guess the main issue with group work would be if some people are not pulling their weight or if some people are having to make up for when people aren't, I guess, contributing their fair share. ($F_4$2)

Assessment

Students considered that the presence of a tutor "keeping a close eye on you" ($M_1$3), especially when assessing their participation, was a stressful situation that made the environment uncomfortable and, in turn, restricted their participation.

> Maybe not just the tutor but the sense that if you're being assessed you get worried that if you don't do something it's going to reflect badly, so it's not the sense that you want to do something but the worry that something is going to happen if you don't. ($F_1$15)

Tutor-Provided Answers

A few students thought that being provided with answers by the tutor was an unhelpful aspect in relation to their learning processes.

> I think being asked to do the questions and being asked in the group is better than the tutor just telling us on the day, "These are the answers," because if you have to answer them you have to d;o your own research but as well, as it goes around to everyone else, you see everyone else's view on the question as well and then the tutor, to wrap up, tells you and adds anything that is missing or corrects anything that's wrong so that is really good because you have to be thinking about it and then you get everyone else's opinion and then you get kind of the right opinion. ($F_1$13)

Competition

A minority of participants indicated that the presence of competition between students had limited sharing of information and made the group atmosphere uncomfortable, which hindered students' learning.

> The competitiveness between group members really impacts. In one of my groups everyone was really competitive and sort of wanted to be the best themselves which I found really quite stressful because it was just hard to work together and people would keep things to themselves more, whereas another group has been a lot less competitive and very open with sharing resources and picking up on each other when we have a knowledge deficit which makes it much more relaxed and then, if you're relaxed, you learn more and then you enjoy it more. ($F_1$17)

Theme 2: Group/Learning Interactions

Students noted that interactions involving *sharing* students' inputs subsequently helped them to learn and broaden their knowledge.

> Everyone can share and kind of contribute. So it's like a very big database of knowledge all coming together and everyone can kind of pool into that. ($F_4$1)

Students also perceived that their learning was strongly mediated by *questioning and explaining to each other*. Students' preparation prior to and sharing of knowledge during group activities allowed them to learn through questioning and explaining. These interactions helped in *confirming and challenging their knowledge* and *filling the gaps*.

> I strongly feel that learning via teaching is a very effective and efficient mode of learning. . . . I think it is all too easy to fall into the trap of feeling like you "know" the topic, but to explain the topic to another person you have to have a good grasp and full understanding of the concept. ($F_4$2, e-mail)

> I also find that just the act of articulating my understanding of a topic helps me improve my confidence in the area and helps me spot any gaps that I may have in my understanding. This improved understanding, confidence, and identifying weaknesses in understanding is further enhanced by questions that I may receive. ($M_1$3, e-mail)

Theme 3: Group and Learning Processes

Students explained that their learning processes involved *managing knowledge conflicts* (Table 3), *active thinking and processing* about links and their relevance, and *comparing and linking* what they already knew to new information.

Table 3. Students' strategies to manage conflicts of knowledge.

Subcodes	Description
"Talk it out"	The group managed differences in opinions through further discussion of these opinions to resolve the conflict.
"Resesarch it"	The group managed conflicts in ideas by doing further research to resolve the conflict.
"Different correct ways"	Students' perceived that there was an advantage in differences in opinions, which confirmed that these conflicts in ideas only demonstrated "different correct ways" and ideas and only related to different understandings of the same thing or different approaches to manage an issue.
"It's up to the majority"	The group managed differences in opinions where a decision of the majority was what they agreed with.
Accepting it	The group managed conflicts in ideas by accepting a compromise solution and avoiding conflicts, which was sometimes used as part of respecting other students' inputs or to avoid the strong personalities.
"Headstrong" and True until proven otherwise	Students perceived that there were difficulties in convincing the "confident students" about another opinion. This section also showed one student's attitude of persisting with his opinion and continuing with convincing other group members that this opinion was the correct answer until they could prove the opposite.

Students reported that questioning and explaining to other students facilitated and reinforced their understanding. Key processes they used included *visualizing, reorganizing, and linking information* into a simplified story when teaching or explaining:

> If you are talking to someone it's a conversation so it's active: you have to be thinking and actively processing and analysing what you're trying to talk about.

> You need to have someone there and be trying to teach them and then they can tell you or ask you questions back and that's the thing that makes you think and then makes you remember and actually understand what you're studying. ($F_4$6)

> For me I like to read and when I read something I would understand it because I visualise it in my head. I am a very visual person, I understand things through maybe mind maps, that helps me to memorise facts, but to actually understand a process I would visualise it very abstractly and then it is more like a story process and when I explain it to someone I go through that story, it's like telling a story, not really memorising the facts but more of creating my own story in my own way and conveying it to the other person. ($F_1$21)

When students from FG 1–7 were asked in follow-up e-mails about these learning processes, they confirmed that these processes applied to them. Some students reported that they visualized the information by drawing diagrams and pictures, while others visualized it by writing information in different forms, such as dot points and tables. An illustrative comment is that "they must be very self aware of their thought processes to evaluate this" ($F_4$1). This comment helps explain students' difficulty in articulating their thought processes during FGs. These learning-focused thought processes were not readily accessible to students, as it was difficult to elicit these elaborations during the initial FGs and required further FG modifications and follow-up e-mails.

Theme 4: Outcomes

This theme represents students' perceptions of both the positive and negative outcomes and the value of groups for their learning. These included the positive outcomes of experiencing knowledge conflicts, learning outcomes of questioning and explaining to each other, the value of learning in groups, and the negative effects of learning in groups (Table 4).

Overall, the students valued CL in several aspects of their learning. However, they identified various positive and negative conditions that influenced their group learning context:

> Hearing them explain it can enhance your learning and it can get you out of your tunnel vision sort of thing. So the differences in opinion offers up that other opinion. ($F_1$14)

> I find it's really helpful to be able explain something to someone else as well. If I think I know a process, in tutorials if I explain it to someone, it solidifies it for myself as well and then I remember it. ($F_1$17)

> Some people don't study and they just come and then maybe someone just keeps teaching them and wasting their time teaching, repeating and repeating, because they have no background knowledge of what they are talking [about] or what they are asking. ($F_4$7)

Students noted that supporting positive conditions and controlling negative conditions could enhance learning and improve their group learning experience, which would subsequently lead to better learning outcomes:

> The only thing is individual learning is a slower but more guaranteed process. Group learning is more of a gamble but when it pays off it pays very well. ($M_4$2)

Discussion

This study, aiming to address the gaps in our understanding of CL that were identified in a systematic review of CL (Almajed et al., 2014), has provided answers to the four research aims of understanding when and how group learning works, what students' goals for CL are, and what the role of knowledge conflicts in CL is for students. The results, presented as four themes relating to the theoretical basis of CL (Dillenbourg, 1999), are discussed and linked to the study aims. For students in this study, CL occurred best when certain group-facilitating contextual features were present or absent. Groups needed to have particular features, such as differences and similarities among group members' attributes and behaviors, and an ideal group size to enable positive CL interactions. Learning together involved particular interactions and processes, which students sometimes have difficulty in describing. As described previously, the learning-focused thought processes were difficult to elicit during the initial FGs and required further FG modifications and follow-up e-mails. Finally, students identified clear positive goals for CL, such as enhancing their learning via group engagement. This included engaging productively when knowledge conflicts were seen as relevant to learning, although sometimes group strategies to deal with conflicts involved avoidance rather than engagement.

There was a strong similarity in students' responses across the main themes in both first- and fourth-year levels apart from a few exceptions. These exceptions mostly related to the nature of the scenarios and having more scope of multiple patient-management approaches for the fourth-year students. One exception related to the positive effects of having knowledge conflicts; the fourth-year students indicated that these conflicts helped them recall and reinforce

Table 4. Summary of the perceived outcomes of learning in groups.

Positive Outcomes of Experiencing Knowledge Conflicts	Learning Outcomes of Questioning and Explaining to Each Other	Value of Learning in Groups	Negative Effects of Learning in Groups
Clearing up any confusion they had.	Clarification of any doubts and improvement in their understanding.	The heterogeneity of group members, which enhanced students' learning.	Making their learning in groups a waste of time when negative issues were present (e.g., other students not interested in learning, the absence of sharing and participating, lack of premeeting preparation, large group size, group members having no common aims, and unclear group goals).
Expanding their knowledge and facilitating a broader mind-set about the discussed topic.	Confirmation of their knowledge.	Being an effective approach that reduced the time required for managing their learning.	
Reinforcing the information in their mind and enhancing their ability to recall this information.	Improvement in their ability to remember what they learned.	Keeping students focused.	
Being beneficial for everyone's learning.		Development of a network with and having support from other students.	Losing control of their learning compared to learning by themselves, especially when other group factors were absent (e.g., preparation before group meeting, being on the same page).
Being in the patient's best interest.		Training for the future work environment.	

their knowledge in addition to helping them to find the best approach for caring for their patient. First-year students did not report these positive effects. The second exception related to the value of learning in groups. First-year students noted that learning in groups simulated their future work environment and also provided them with academic and social support. In contrast, fourth-year students did not comment on this aspect of learning in groups. Both groups participated in team-building activities early in their first year. However, by their fourth year, the major focus for students is on individually providing care for their own patients. They have limited opportunity for managing or providing patient care in teams. In addition, fourth-year students pointed out that the increase in their course workload and deadlines inhibited their learning. First-year students did not report this as an issue with their learning experience. First-year students have a lighter clinical load than fourth-year students, which may explain this difference.

Context

Addressing the first aim of this study, dental students reported that the diverse social and academic nature of their groups, with respect to group members' background and experiences, were key factors in successful experiences in a CL context. The findings from this study build on the outcomes from previous studies (reviewed in Almajed et al., 2014); however, these previous studies were limited in terms of their methodology and reporting (Almajed et al., 2014).

The current study's findings are consistent with the theoretical basis of group heterogeneity as necessary to facilitate "constructive controversy," knowledge building, and problem solving in group meetings (Johnson & Johnson, 2009, p. 348; Scardamalia, 2002). Vygotsky argued that the "zone of proximal development (ZPD)" surrounds individual core knowledge and represents the area to which the individual can extend his/her knowledge with further guidance and help (Vygotsky, 1978). In a group of students, ZPDs overlap and enable shared zones to be wider, especially when students learn in diverse groups that contain heterogeneous group members' experiences and skills (Bruffee, 1999).

The motivating aspect of heterogeneous groups described by the participants in the current study also aligns with CL theories. These findings are consistent with the "role of social comparison": the presence of other students with different

academic abilities facilitates and motivates other students' learning, as they compare their abilities with other students' abilities (Johnson & Johnson, 2009; Littleton & Häkkinen, 1999, p. 28). Similarly, from a "motivational perspective" position, when group success depends on group member performances, students work harder and help each other to get a better result (Slavin, 1996). Students become intrinsically motivated if they are interested in the topic or context (e.g., related to being a dentist), are challenged, or complete the task, which in turn increases their sense of satisfaction (Hmelo-Silver, 2004). For the students in this study, being a member of a group of hardworking and successful students created a challenge, and they aimed to match other students.

While learning in a heterogeneous group was clearly of value for students, they also valued certain group member attributes as being similar. These findings are consistent with previous studies, such that being friends and having similar personalities, motivations, and goals were beneficial (reviewed in Almajed et al., 2014). However, these studies were limited, being derived from students' ratings of a restricted range of survey items. The issue of dissimilarity of these attributes and the inhibiting effect of inappropriate student behaviors on the learning of other group members has also been reported (reviewed in Almajed et al., 2014).

These findings of similarities regarding group attributes were not unexpected theoretically. To establish a collaborative setting, students must be comparable in actions, knowledge (similarity in opinions is not required), and status; have shared goals; and do tasks together (Dillenbourg, 1999). CL is based on the notion of social interdependence in which students share similar goals, resources, roles, rewards, and tasks, and individual success depends on and is affected by each other's activities (Johnson & Johnson, 2009). This is consistent with a "motivational perspective" of CL, in which linking students' success with their group's success facilitates students' motivation and collaboration (Slavin, 1996, p. 44). For students in the current study, the importance of commitment to group work, demonstrated by preparing before group meetings, also fits with CL theories. Students' accountability via preparation and working toward group tasks is one of the basic elements of social interdependence and cooperation in CL (Johnson et al., 2007). Therefore, we conclude that it is important to encourage student preparation before group meetings so that constructive sessions that facilitate student participation, in terms of sharing, discussing, and explaining, are possible. It is important to note that preparation enables all students to engage, which includes verbal contributions as well as moments of silent engagement and participation (Jin, 2012; Remedios et al., 2008).

Other findings about when learning happens and group context include the importance of having a small group to facilitate and having clearer directions and goals to enable better organization. These findings are consistent with the reported group sizes recommended for meaningful interactions (two to four members) (Johnson et al., 2007). It has also been reported in a meta-analysis of studies in psychology that large group sizes lead to reduction in both students' performance and group cohesiveness (Mullen & Copper, 1994).

In contrast to the positive effect of a small group, students noted the negative influence of group choices about how they managed their course workload. Theoretically, the process of dividing a group task can facilitate workload reduction without reducing collaboration between students to accomplish tasks (Dillenbourg, 1999). Dillenbourg (1999) differentiated between "collaboration" and "cooperation": in a "collaborative" situation students may split their tasks and be required to coordinate with each other to accomplish their group tasks ("horizontal" division), while in a "cooperative" situation students split their tasks and work independently ("vertical" division). Students in this study mentioned that the stress of their increased workload across the year led them to divide the tasks vertically, which meant that they cooperated by completing the tasks independently, despite recognizing that this was not useful for their learning.

Students also said that learning collaboratively was enhanced when topics were more relevant and less certain. Topics leading to discussing different ideas (e.g., patient management) increased interest and facilitated learning. This study provides support for a previous study in which students expressed preferences for selecting topics and content of interest to them (Gleeson, 2010). This enhanced learning is explained by "situated learning" theory, in which learning is situated in an authentic context that involves realistic use of that knowledge (Littleton & Häkkinen, 1999).

The final contextual aspect of when CL occurs related to the tutor. Students perceived the role of the tutor as someone to provide direction, knowledge, and guidance and manage students' behaviors (i.e., dominant and quiet behaviors). However, students also reported that having tutors assess individual performances made group environments stressful and uncomfortable. Students perceived that this caused them to dominate discussions to demonstrate their competency. However, students in this study also noted that assessment is necessary to keep them committed to the group work and encourage them to prepare. These results build on those observed in earlier studies, which found that students preferred having a tutor to monitor, guide, focus, and encourage participation in their group (reviewed in Almajed et al., 2014). The reported need of students in this study for tutors to manage inappropriate behavior and the effect of competition on their learning are congruent with the basis of CL. It is important for students to feel safe to participate and discuss

their opinions, which is enhanced by the "cooperative context" and hindered by the "competitive context" (Johnson & Johnson, 2009, p. 348).

Interactions and Processes

The second aim of the study—what CL involves—was explained under the two themes of interactions and processes, described by Dillenbourg (1999). For students in this study, key interactions that supported group learning were sharing information and resources, which included variations in perspectives and understandings. They also explained that questioning and explaining to each other enhanced their learning. They indicated that both participants in the explanation process (the individual who explained the information and the one who was provided with the explanations) learned from this process. This required them to prepare information and organize ideas, enabled their ideas to be challenged, and supported their identification of gaps/misunderstandings, thus modifying and shaping their ideas. In this study, students explained that they used a number of cognitive processes such as visualizing and reorganizing material to understand and communicate it better.

Students in other studies perceived that sharing information and explaining positively affected learning (reviewed in Almajed et al., 2014). These findings are consistent with CL theories. Learning must be a "constructive" and "collaborative process" in which students' elaborations and interactions support learning (Dolmans, De Grave, Wolfhagen, & Van Der Vleuten, 2005, p. 732). To learn collaboratively, students should share goals and responsibilities, be reciprocally reliant on each other, and interact with each other to reach common agreement on their ideas (Dolmans et al., 2005; Johnson et al., 2007). In CL contexts, students' construction of understanding is explained by social constructivism and sociocultural theories of Vygotsky's social development theory (Littleton & Häkkinen, 1999; Smith & MacGregor, 1992). In this social context, students' collaborative interactions (e.g., analyzing, arguing, explaining, comparing, and linking) help to create different ideas and understandings (Littleton & Häkkinen, 1999; Smith & MacGregor, 1992). Similarly, from a "developmental perspective" of CL, collaborative interactions develop students' understanding and knowledge (Slavin, 1996). Therefore, in CL contexts, students are at the center of the learning process constructing their knowledge through their interactions and processes, in contrast to the teacher conveying information to the student. Furthermore, other studies have reported that the students practiced "active" silence during CL to process and think about the explained information (Imafuku, Kataoka, Mayahara, Suzuki, & Saiki, 2014; Jin, 2012; Remedios et al., 2008). Also, Jin (2012) reported that students' silence might be a signal of allowing the person with more knowledge in a certain topic area to lead and control the discussion.

With regard to learning processes, students in the study perceived that their learning was enhanced by certain thought-related learning processes. These processes included visualizing and linking information together and comparing and linking any new information to what they already knew. It was noteworthy that students' levels of awareness of their thinking processes during learning made it difficult for them to explain these processes. Students' elaborations of their thinking processes were achieved only after extensive questioning and probing, including revision of questions during FGs and in follow-up e-mails. In response to these changes, students did note that they actively thought about and processed information when learning. The difficulty that students had explaining their thought-related learning processes suggested that these processes were not readily accessible when asked. Students confirmed that they practiced these processes subconsciously.

It is of note that most of the students in this study considered knowledge conflicts as opportunities for further learning by exposing them to different opinions and aspects of knowledge. These findings addressed the fourth research aim about the role of knowledge conflicts, which was a gap in previous studies (Almajed et al., 2014). This is consistent with the theoretical underpinnings of the "socio-cognitive conflicts" of CL (Littleton & Häkkinen, 1999, p. 21), namely that conflicting opinions between peers elicit learning and provide alternative opinions to their original positions. Furthermore, conflicts between students produce a "conceptual conflict" in a student's mind as the new/other ideas challenge the student's original ideas and create a situation of ambiguity, which leads to "epistemic curiosity" that enhances student's searching and learning (Johnson & Johnson, 2009, p. 343). This process of curiosity fits with the "situational interest hypothesis," which states that formation of this gap in a student's knowledge leads to an increase in the student's interest to explore the topic further (Schmidt, Rotgans, & Yew, 2011, p. 794). Generally, the students were aware that differences in opinions were not personal conflicts; however, a few students indicated that they avoided these conflicts out of respect for their colleagues' contributions. This raises the importance of the tutor's role in guiding students so that opportunities for learning from knowledge conflicts are not lost.

Effects

Effects of CL processes and activities, presented as the results "Theme 4 Outcomes," comprise the fourth element of CL (Dillenbourg, 1999) and address the third research aim about students' goals for group learning and the value of CL. Overall, students in the current study appreciated and valued

their collaborative learning experiences in terms of learning in homogenous groups in relation to their group member attributes, having knowledge conflicts, and being involved in questioning and explaining to each other. Only first-year students indicated that learning in groups provided them with social and academic support and simulated their future work environment. These benefits may be more relevant for first-year students, as many were experiencing their first year away from home.

While students reported experiencing CL in ways that are consistent with theoretical ideas of CL when it worked effectively, they did not always have positive experiences of CL. Students' inappropriate behaviors and heterogeneity in terms of their attributes and approaches toward group work affected their learning negatively. Specifically, students noted that in certain situations their group did not work well; for example, if the group had dominant students or if group members did not have the same level of motivation and aims. In these situations, students considered that learning in groups was a waste of their time. Moreover, students reported that in group learning, the control of their learning transferred from their own control to the group as a whole. Students considered this a disadvantage, especially if the group activities were not aligned with the learning focus for all group members. Some students considered this effect a consequence of not having the "right batch of people," as this situation led to a less productive group dynamic. Specifically, not having the "right batch of people" subsequently delayed/changed the progress of their learning compared with learning individually, whereby they could study the required information without having to rely on other group members. As a result, the negative effects of having negative group dynamics led to a feeling of losing control over learning and wasting time.

Limitations

This study found evidence related to previously identified gaps in our knowledge. However, protocol restraints (e.g., a small sample of students from one program/time and available resources) limit the findings. Additionally, students' perceptions of learning collaboratively are likely to be influenced by their previous CL experiences, as part of either their current program or previous programs (Prosser, 2004). A summary of participants' previous CL experiences was not obtained in the current study. Therefore, in subsequent studies, clarifying students' current perceptions about their learning processes and outcomes against their previous CL experiences would improve our understanding of factors necessary to address issues from previous CL experiences and maximize students' learning experiences in subsequent CL settings. The current study used a purposive sampling of volunteers (Coyne, 1997), but they may not be representative of their cohorts (e.g., in the current study, fewer male students participated by comparison with the first- and fourth-year cohorts). It is known that volunteers in medical education studies are often better-performing students, resulting in positive selection bias (Callahan, Hojat, & Gonnella, 2007). Therefore, these findings must be interpreted carefully. Further exploration of the current findings in a larger sample from more than one program (e.g., using surveys as part of a mixed methods approach) is required, thus increasing the representativeness of these findings across a range of CL contexts (Creswell, 2003).

It is also important to recognize the limitations of FGs to understand individual thoughts and experiences, as individual participation could be affected by the social context of the FG (Krueger & Casey, 2002). However, in the current study the focus was on students' constructed understandings more than the individual lived experiences. Therefore, this perspective should reduce the limitation of using FGs. In addition, this study was an exploratory study; hence, a qualitative approach with FGs was appropriate to address the research aims.

Implications for Practice

The findings from the current study have implications for the implementation of CL. These include aspects of student, tutor, and course development. Students may collaborate and learn more effectively in heterogeneous groups if they are supported to develop social and cross-cultural knowledge and communication skills (Johnson & Johnson, 2009; Pearson, 1999). Homogenous groups with regard to CL-appropriate attitudes can develop through enhancing students' interdependence and linking individual success and increasing accountability (Johnson et al., 2007; Slavin, 1996). Staff must monitor workload so that students can balance individual and group study and learning demands, enabling collaboration over cooperation (Dillenbourg, 1999). Tutors/group members need to be supported to monitor group discussion and establish cooperative rather than competitive environments, highlighting the value of managing knowledge conflicts through further questioning, discussion, and elaboration (Aarnio, Lindblom-Ylänne, Nieminen, & Pyörälä, 2014). Students must be supported in their learning interactions and processes, including developing skills in questioning and explaining to each other, managing conflicts in knowledge, and analyzing their underlying thinking, to facilitate their current and future group and individual learning (Johnson et al., 2007). Prosser (2004) indicated that it is important to support students' understandings of their course design and how that is related to their learning context to improve students' adopted approaches and learning outcomes.

Conclusions

This study has explained students' perspectives about key factors for facilitating positive learning experiences in an inquiry-based CL context. These include recognizing which aspects of a CL group ought be heterogeneous and which homogeneous, such as having diverse backgrounds but similar dispositions to learning in groups; encouraging balanced participation and interactions, especially questioning, explaining, and addressing knowledge conflicts; and helping students to identify and understand their thought-related learning processes. These student perspectives are consistent with key theoretical elements of CL. Assisting students to understand the role of these factors and the consequent positive impact on their learning could improve their CL experiences and outcomes. Further exploration of the current findings across a range of CL contexts is required.

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