The Conduct of Paediatric Surgery Collaborative Learning Cases Via an Online Platform During the COVID-19 Outbreak: Challenges and Lessons Learnt

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Categories: Teaching and Learning, Technology, Undergraduate/Graduate

Received: 11/07/2020
Published: 25/11/2020

Abstract

Introduction
A pedagogical approach termed as Collaboration Learning Cases (CLC) is conventionally conducted in a physical classroom (P-CLC) to encourage active learning in a shared dialogic space. The cessation of physical classroom activities as a result of the COVID-19 pandemic has paved the way for virtual classroom experiences. This study aims to compare the student and tutor experiences between P-CLC and virtual CLC (V-CLC).

Methods
There were eight clinical student subgroups and five paediatric surgery tutors involved in V-CLC. Microsoft Teams was the online platform chosen for V-CLC. The study employed an action research approach with mixed methods. Comparative analysis of the quantitative data across four different domains (content, facilitation, relevance and user interface) based on the 5-point Likert scale between P-CLC and V-CLC was performed. An inductive and iterative process of information collection, analysis and thematic classification was also employed for the qualitative data.

Results
The mean class size and student-to-facilitator ratio was higher in V-CLC. Both approaches were comparable for facilitator effectiveness (p=0.383) and being systematic and understandable (p=0.907). However, P-CLC had significantly higher scores in conduciveness, pace and relevance as compared to V-CLC. Student satisfaction scores were also higher in P-CLC [V-CLC: 78.6 (75.4-81.8) vs P-CLC: 87.6 (86.4-88.7), p<0.001]. Nonetheless, most students would still recommend V-CLC to their peers (p=0.494). Four main thematic areas such as platform-specific concerns, student engagement, interactivity and lesson pacing were identified for possible improvement.
Conclusion

While V-CLC may not fully replicate a physical classroom experience, it provides a viable alternative during the COVID-19 pandemic. Successful application of this virtual collaborative pedagogy model to other different contexts will require bespoke adjustments for optimal adaptation to local conditions.

Keywords: Collaborative learning cases; virtual classroom; online platform; COVID-19; medical student education

Introduction

As an adaptation to the Collaborative Pedagogical Model employed by the Faculty of Education, University of Cambridge, a new approach termed as Collaborative Learning Cases (CLC) was implemented by the Yong Loo Lin School of Medicine (YLLSoM), National University of Singapore to facilitate integration and collaborative learning (Lee et al., 2018). This initiative allowed pre-clinical students to integrate biomedical science knowledge through a pedagogical approach of which active learning involving the scaffolding of knowledge and collaboration in a shared dialogic space were encouraged. The conduct of CLC was typically set in a classroom where active student-to-student and student-to-tutor interactions happened in direct physical presence.

But when Coronavirus Disease 2019 (COVID-19) pandemic hit and brought about disruption in almost all aspects of our lives; the classical method of face-to-face teaching was re-examined to be in congruent with the public health measures which were enacted to contain the outbreak. In February 2020, the decision to cease clinical and classroom activities for medical students was announced by YLLSoM. To facilitate learning continuity, modifications were to be made to the mode of delivery. An online teaching platform was proposed to enable learning continuity for students.

In this manuscript, we describe our experience as YLLSoM paediatric surgery educators in the conduct of CLC using Microsoft Teams, which is an online unified communication and collaboration platform, during the current COVID-19 pandemic.

Methods

The overall paediatric surgery CLC curriculum involved three different phases as follows:

1. Pre-reading phase – Students were given pre-reading materials and didactic lectures to activate prior knowledge.
2. Case revision phase – Students were presented with clinical scenarios and were required to discuss with their clinical group peers and individual facilitators before presenting their answers. The facilitators served to prompt discussions, scaffold ideas and clarify any misconceptions among students.
3. Summary phase – Key learning points were summarized and linked back to the outcomes of the clinical cases. Students were also able to clarify any further doubts and knowledge gaps during this phase.

The CLC was designed to serve both case revision and summary phases. This was previously conducted in a physical classroom (P-CLC), in which the participants were divided into their respective clinical groups of 5-6 students each. Pre-reading materials were allocated to each group, and a physical whiteboard as well as internet access was provided to facilitate discussion and presentation. The chief facilitator would take charge of the entire cohort of students by bringing them through the various clinical cases illustrated on a PowerPoint (Microsoft, Redmond,
Washington, US) presentation before allowing them to discuss their approach and answers within individual groups. Interactive elements such as straw polls, multiple choice and free-answer questions were incorporated into the presentation via Poll Everywhere inserts (Poll Everywhere, San Francisco, US). During the breakout sessions, co-facilitators would also join their pre-assigned clinical groups to guide the group discussion.

With the usage of Microsoft Teams, five paediatric surgery educators were involved in the virtual classroom CLC (V-CLC) during the COVID-19 pandemic. Majority of them had significant experience as facilitators in the physical classroom CLC (P-CLC) prior to the COVID-19 pandemic. In V-CLC, clinical groups of 5-6 students were tasked to meet up at a common location with a shared workstation. The chief facilitator took charge of the main online conference room which housed all of the involved participants before splitting them into individual virtual breakout rooms as a clinical group. Facilitators were then coordinated to enter these breakout rooms to engage the clinical groups assigned to them. A training session by the information technology team was conducted to familiarize the group of facilitators with the Microsoft Teams platform (Microsoft, Redmond, Washington, US), and two trial sessions were also held subsequently to allow facilitators to be acquainted with the actual day workflow. This is further illustrated in Figure 1.

**Figure 1:** Lesson plan schematic for virtual collaborative learning

The study was reviewed by the institutional ethics review board and received an ethics exemption. Consent was implied as part of curriculum delivery in YLLSoM. All questionnaire submissions were anonymized to ensure the confidentiality of this research and to ensure objectivity of feedback. At the end of each CLC session, feedback for both physical and virtual CLCs was obtained via an evaluation questionnaire consisting of 6 questions. Each question assessed a separate domain – content, facilitation, relevance and user interface, via both a quantitative 5-point Likert scale, as well a qualitative semi-structured component (Dicicco-Bloom and Crabtree, 2006). Comparative analysis of the evaluation scores between V-CLC and P-CLC was performed using the two-sample t-test and a p-value of less than 0.05 was considered statistically significant. Qualitative feedback was obtained from both tutors and students. Emergent themes that were identified during the conduct of the teachings were evaluated and discussed between the authors (Tan and Lee). Broad themes were developed to analyze the student feedback, which was independently verified by the corresponding author (Nyo).

We ensured the quality and credibility by iterative data collection. For each cycle of students, the main feedback findings were reviewed and discussed with the facilitators. Improvements to the teaching facilities and methodologies were made based on student feedback, and these changes were analyzed in the next cycle of students to triangulate data objectivity and consistency between batches of students. To ensure objectivity of our study, we
circulated the student feedback to non-study faculty members and obtained their inputs towards addressing the issues raised in the feedback. Facilitator feedback was also obtained after each session, which enabled faculty members to improve the teaching process as well as fine-tune their approach to the topics at hand.

**Results/Analysis**

The 2019/2020 YLLSoM cohort consisting of 302 third year medical undergraduates was divided into 8 subgroups, with a mean class size of 39 students. Each class underwent two sessions based on two clinical scenarios: paediatric groin and scrotal conditions, and the paediatric acute abdomen. At the point of suspension of physical lessons, 6 subgroups had attended a total of 12 sessions of P-CLC, while 2 subgroups underwent a combined 3 sessions of V-CLC.

Student attendance for both types of CLC was high (>99.5%), indicating a strong intrinsic motivation and desire to learn. The median number of participants in V-CLC was approximately twice that of P-CLC [V-CLC: 68.7 (68.0-69.3) vs P-CLC: 38.8 (37.0-40.7), p<0.001]. Consequently, the student-to-facilitator ratio was also significantly higher in the V-CLC group [V-CLC: 17.2 (17.1-17.2) vs P-CLC: 12.6 (10.7-14.5), p = 0.019]. The effectiveness of the facilitators between both groups were comparable (p=0.383). Both approaches were comparable in terms of being systematic and understandable (p=0.907). However, P-CLC obtained significantly higher scores in the conduciveness, pace and relevance of the sessions as compared to V-CLC. While student satisfaction scores were also higher in the P-CLC group [V-CLC: 78.6 (75.4-81.8) vs P-CLC: 87.6 (86.4-88.7), p<0.001], most students would still recommend V-CLC to their peers (Table 1).

**Table 1. Student response to virtual classroom teaching**

| Medical Student Feedback | Physical Classroom (n = 466) | Virtual Classroom (n = 206) | p-value |
|---------------------------|-----------------------------|-----------------------------|---------|
| **Tutorial Class**        |                             |                             |         |
| Number of sessions        | 12                          | 3                           |         |
| Mean Class size           | 38.8 (37.0 – 40.7)          | 68.7 (68.0 – 69.3)          | <0.001  |
| Mean Attendance rate      | 99.8 (99.4 – 100.0)         | 99.5 (98.6 – 100.0)         | 0.260   |
| Mean Student-to-Faculty Ratio | 12.6 (10.7 – 14.5)    | 17.2 (17.1 – 17.2)         | 0.019   |
| **Post-Tutorial Survey**  |                             |                             |         |
| The facility is conducive for learning | 4.32 (4.25 – 4.39)          | 3.52 (3.32 – 3.73)          | <0.001  |
| The presentation is systematic and understandable. | 4.46 (4.40 – 4.52)          | 4.19 (4.05 – 4.33)          | 0.907   |
| The facilitators were effective. | 4.50 (4.44 – 4.56)          | 4.58 (4.45 – 4.71)          | 0.383   |
| The duration and pace of the teaching was appropriate. | 4.41 (4.34 – 4.48)          | 3.69 (3.45 – 3.93)          | <0.001  |
| I know what to do when I encounter a similar clinical situation. | 4.16 (4.09 – 4.23)          | 3.64 (3.45 – 3.83)          | <0.001  |
| I will recommend this teaching to my peers. | 4.42 (4.35 – 4.49)          | 4.06 (3.88 – 4.24)          | 0.494   |
| Student Satisfaction Score (%) | 87.6 (86.4 – 88.7)          | 78.6 (75.4 – 81.8)          | <0.001  |

†Student feedback was assessed on a five-point Likert scale with 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree. Values in parentheses represent 95% confidence intervals.

Qualitatively four broad themes were identified in the feedback: technology and platform-specific concerns, student engagement, interactivity and pacing of the session. Individual specific concerns highlighted by both the students and the facilitators are listed in Table 2.

**Table 2: Qualitative feedback to virtual classroom teaching**

| Theme                                      | Specific Concerns                                                                 |
|--------------------------------------------|----------------------------------------------------------------------------------|
| Technology / Platform-specific concerns    | • Coordination between individual breakout groups during breakout sessions, due to different speeds of accomplishing teaching objectives  |
|                                            | • Students felt that a physical classroom is still most ideal, but the virtual classroom is a viable alternative. |
Student Engagement

- Student engagement is harder, as it is easier for reticent individuals to stay in the background and avoid interaction.
- Smaller student-to-teacher ratios would make such students easier to engage during the individual breakout sessions.

Interactivity

- Having interactive elements (e.g. spot polls, open answer questions) improves knowledge retention and improves critical thinking skills.
- Student participation in polls was high due to the anonymity of submissions, which encourages greater participation.

Lesson Pacing

- Facilitators found it harder to gauge the individual understanding of the students in the breakout group. Speed of content delivery may be adequate for most, but may be too fast for some students.

1. Technology and platform-specific concerns

1.1 Co-ordination between breakout groups

Both teachers and students found that co-ordination between breakout groups was difficult to achieve in V-CLC. In the physical classroom, verbal cues to return to the main body for continuation of the lesson plan after a breakout session was easily accomplished; this was harder to achieve in a virtual environment due to the individual groups achieving the learning objectives at different speeds.

"It was quite messy when we split into our individual breakout groups as we have to keep jumping between channels."

1.2 Familiarity with the physical classroom paradigm

Students felt that they were more used to the physical classroom, and the relative lack of familiarity with both the software and the experience of virtual learning adversely impacted their learning.

"Nothing truly beats being physically present to learn from these tutorial sessions, but this is not a bad alternative given the current circumstances."

"I still prefer the physical CLC, but I feel that the online CLC is actually quite a good modality for learning now given the COVID-19 situation as compared to other teaching methods."

2. Student engagement

Facilitators felt that it was easier for reticent individuals to avoid actively participating in the lesson, due to the nature of virtual learning. Two means of mitigation were suggested: to call out individuals by name during the main group teaching, and to increase the number of facilitators to reduce the size of the breakout group.

"It was more difficult to elicit responses from the students, especially the more reticent group members over the conferencing software."

"It would be better if tutors can call out individual names to answer certain questions rather than wait for a response."

"It was difficult to coordinate responses when several groups answered simultaneously."

3. Interactivity

Students found the inclusion of interactive Poll Everywhere elements overwhelmingly positive. They felt that such elements stimulated internal discussion and improved both engagement and knowledge retention. Because of the anonymous nature of the polling, the less reticent students were more inclined to engage in the lesson.
"I liked the questions conducted through an online poll as it was an efficient way of getting responses and allowed us to think critically."

4. Lesson Pacing

Facilitators found it difficult to pace the lesson to the satisfaction of all members of the class due to the absence of non-verbal cues during virtual teaching. Time management was also an issue due to the various facilitators running breakout sessions at different paces.

"Compared to a physical classroom, I found time management in the virtual classroom more challenging. It was more time consuming to transfer between breakout rooms, and time coordination between different facilitators was difficult via this online platform."

Discussion

The paediatric surgery CLC programme in YLLSoM was established over the last two years (Lee et al., 2018). It was conducted specifically for third-year medical students as part of their general surgery postings' rotation. The CLC programme served to bridge the gap between the pre-clinical and clinical phase in their formative years by providing a collaborative platform that encouraged them to apply pre-existing knowledge in common clinical scenarios. Tutors facilitate an active discussion within student groups and amongst facilitators and the students. The students were expected to think critically on their feet and arrive at an appropriate approach to solve clinical scenarios on the topic under discussion.

The P-CLC had been well-received based on the absolute feedback scores (Table 1). However, the need for segregation as an infection-control measure in the current COVID-19 pandemic had challenged existing medical education norms. While an online platform to continue teaching activities was a viable option given the situation, there are concerns of a lack of physical interaction between student and tutor, together with the logistics of organizing and delivering an effective V-CLC. The degree of uncertainty surrounding the feasibility of conducting CLC via an online platform was even greater given that the programme was centered upon bidirectional students-to-tutors collaboration.

The challenge from the outset was to find a suitable software that was accessible, easy to navigate and secure. In addition, it had to provide opportunities for the student cohort to be divided into smaller groups to facilitate individual group discussions with their respective tutors. Microsoft Teams was deemed as a suitable software; it had a "breakout group" function which allowed facilitators to assign students into a smaller group for part of the session. In addition, it also provided a "share screen" option that allowed the chief facilitator to broadcast PowerPoint slides from his desktop. The "share screen" option also served as a "virtual whiteboard" as tutors were able to type brief pointers or make use of visual aids using the relevant software from their individual workstation. Conversely, students could make use of this function to share answers with their facilitators during the individual breakout sessions. Microsoft Teams was also able to incorporate applications such as Poll Everywhere (web-based audience response system) into its interface to allow for interactive activities to be embedded. This feature further enhanced the learning experience from interaction during CLC. Other useful practical functions such as file-uploading, bulletin-board-style chat and attendance-taking features were also available.

There were various difficulties encountered by the tutors during V-CLC and time management during the session was one of the key challenges. While network latency and connectivity issues contributed to some delay, this issue
could be easily circumvented with a stronger network system. As each tutor was in-charge of several breakout groups remotely, difficulty arose with following the extent and progress of the groups’ discussions. This could be improved by decreasing the students-to-teacher ratio. The chat function in the software was also vital in mitigating this issue as student groups could use it to liaise with their respective tutors to update on their progress. The chat function could also be used between tutors to coordinate their timings during breakout sessions. The presence of an overall timekeeper might also be useful to improve time management. The other limitation of V-CLC from the tutor perspective was student engagement. The tutors unanimously agreed that the students tend to be more passive compared to a physical classroom setting, and that it was more difficult to elicit responses from them. This issue was recognized by the students as well. Thus, we would like to propose that tutors familiarize themselves with the names and faces of their students prior to the teaching session so that questions could be directed for better student engagement during the V-CLC. The management of simultaneous responses and questions by students in the main conference room could potentially be disruptive to the chief facilitator running the lesson. This was resolved by encouraging the use of the chat function for routine question and answering with the co-facilitators being also able to answer on behalf of the chief facilitator. Furthermore, the chat platform allowed the students to feel less inhibited in asking questions and promoted higher class participation rates.

The adoption of an online platform did not significantly affect the organization and presentation of the CLC session. This observation was not surprising given that the main content of P-CLC was also delivered through a PowerPoint presentation. Interestingly, the effectiveness of the tutors was comparable between both P-CLC and V-CLC groups. This was likely contributed by the fact that majority of the paediatric surgery educators had significant experience in P-CLC and had carried their expertise over to V-CLC. It was also advantageous that majority of the tutors were consultant-grade surgeons who possessed a good grasp of knowledge in the paediatric surgery field. Nonetheless, the COVID-19 pandemic had resulted in manpower depletion for education purposes and the fine balance between decreasing student-to-tutor ratio and maintenance of tutor quality was to be weighed carefully.

The main limitation of V-CLC from the student perspective was the inconvenience of switching between channels during breakout sessions. The difficulty in coordination between individual sub-groups during breakout sessions also resulted in unequal pacing. We propose that education groups looking to adopt V-CLC to minimize the number of breakout sessions required. Instead, it might be worthwhile to collapse several questions into one breakout session, thereby reducing the inconvenience experienced by students. This measure would also allow the lengthening of each breakout session, giving tutors more allocated time to work with the students. In our experience, one 30-minute or two 15-minute breakout group sessions in a two-hour V-CLC provided the most optimal balance. Alternatively, some of the breakout sessions could potentially be replaced by delivering more questions via a web-based audience response system. This move could decrease the number of breakout sessions required, but yet might maintain a certain degree of student engagement and participation which was of essence in CLC. Another limitation of the current study was that it did not take into account the other virtual classroom teaching sessions the students had undergone prior to the paediatric surgery V-CLC, and the fatigue arising from their attendance in multiple sessions might have affected their evaluation.

Conclusion

Therefore, we conclude that the pediatric surgery curriculum for medical undergraduates may be delivered effectively in a virtual setting using a collaborative-learning-case methodology on a currently available software for online communication and collaboration. Although the virtual online session does not replicate the full experience of a physical classroom teaching, the challenges may be overcome with alternative measures as in our Asian context. Successful application of this virtual collaborative pedagogy model to other different contexts will require bespoke adjustments for optimal adaptation to local conditions.
Take Home Messages

- Collaboration Learning Cases encourages active learning through a shared dialogic space and can be effectively conducted in a virtual classroom setting.
- The conventional physical classroom experience is threatened by the COVID19 pandemic.
- Emphasis should be placed to improve technology-specific concerns, student engagement, interactivity and lesson pacing in a virtual classroom to replicate the full experience of a physical classroom teaching.
- Virtual classroom is a viable alternative to allow learning continuity

Notes On Contributors

Dr Jarrod Kah Hwee Tan is a surgical resident with a growing interest in medical education.

Dr Yang Yang Lee is a pediatric surgery fellow with a keen interest in pushing the boundaries of medical education with the latest technology available.

Dr Lynnette Rui Ling Tan is a surgical resident with a growing interest in medical education.

Dr Yee Ling Cheong is a consultant surgeon with the pediatric surgery department who strives to improve the quality of teaching sessions for undergraduate medical students.

Dr Yoke Lin Nyo is a consultant surgeon with the pediatric surgery department and also an Assistant Professor of the Yong Loo Lin School of Medicine, National University of Singapore. He is responsible for the pediatric surgery undergraduate curriculum and strives to deliver the best teaching sessions for students.

Acknowledgements

We thank Dr Dale Lincoln Loh, Dr Vidyadhar Mali and Dr Mohamed Abubacker Ahamed Faiz Ali from the Department of Paediatric Surgery, Khoo Teck Puat – National University Children's Medical Institute, National University Hospital for their contributions as paediatric surgery CLC tutors. We would also like to acknowledge Dr Ong Lin Yin, Dr Low Yee and Dr Caroline Ong from Department of Paediatric Surgery, KK Women’s and Children's Hospital, Singapore for their contributions to the CLC case writing and for their role as paediatric surgery CLC tutors.

Figure 1. Source: the author.

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Appendices

None.

Declarations

The author has declared that there are no conflicts of interest.

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Ethics Statement

The study received an ethics exemption by the National Healthcare Group Domain Specific Review Board (NHG DSRB).

External Funding

This article has not had any External Funding

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