MONOGRAPH

A Synchronous Hybrid Team-Based Learning Class: Why and How to Do It?

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Accepted: 23 March 2022 / Published online: 26 April 2022
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Abstract
COVID-19 pandemic has transformed much of the medical curriculum delivery from in person to online. Given that interpersonal interaction facilitates team cohesion and professional identity formation, prolonged online learning with minimal social interaction might impact these competencies in medical education. To mitigate the impact of prolonged social isolation, we conducted synchronous team-based learning (TBL) classes, where half the class is physically present and the other is connected via an online platform, termed hybrid TBL. We present practical tips in implementing hybrid TBL for educators teaching in large-sized classes, should conditions exist where not all students can attend in person.

Keywords Engagement · Team dynamics · Professional identity formation · Interpersonal interactions · Large TBL classes · Pandemic teaching

Introduction

As the COVID-19 pandemic continues to ravage worldwide, educators have been required to move from in-person classes to an online setting to ensure the continuity of education [1, 2]. Some institutions were aided by their experiences from previously implemented pandemic preparation responses due to curriculum disruption during the SARS and H1N1 influenza outbreaks [2–4]. As the world enters the next phase of this pandemic, where many countries are going through cycles of tightening and loosening of restriction measures, there are now opportunities to allow a limited number of students to return to campus for an in-person education. However, returning to full in-person education remains a challenge for a variety of reasons. These limiting factors include the inability to accommodate the entire class size at a teaching venue due to prevailing social distancing measures, and the gradual adoption of vaccination differentiation measures, such as only allowing fully vaccinated individuals to attend in-person classes [5].

Why Implement Hybrid Classes Instead of Remaining Online?

Considering the concerns for resuming in-person classes, we offer a strategy to implement a hybrid arrangement of synchronous in-person and online classes, which will allow a fraction of students to resume in-person education. Such innovations that will allow the resumption of in-person education in a hybrid setting, in the short term, would provide a solution during the pandemic and, in the long term, would allow educators to rethink issues about class size and engagement strategies post-pandemic. With minimal changes in resource requirements, a hybrid class will allow educators to expand class size without the size of the physical venue being a limiting factor.

Even though the impact of prolonged online learning on the students’ development can be mitigated by different educational settings or instructional methods [6], we advocate for resuming some form of in-person education during the ongoing pandemic, because we have previously shown that whilst the students’ perceptions of learning were not negatively affected, they perceived that the development of their interpersonal skills was impacted in a fully online
team-based learning (TBL) environment [2]. Similarly, several other studies have found that students perceived unsatisfactory interpersonal interactions when immersed in a prolonged online learning environment [7–12], as shown by poorer ratings for teamwork interdependence in an online TBL environment, despite similar academic performances in both online and in-person TBL classes [7, 8]. The suboptimal interpersonal interaction is further compounded by the social isolation that has occurred due to the COVID-19 pandemic, which has been shown to have a significant psychological impact on students [13–15]. In the case of healthcare professional students, the suboptimal social interactions due to prolonged online learning lead to two other concerns: suboptimal team dynamics and delayed professional identity formation [7, 16–20].

**Team Dynamics is Suboptimal in Online Classes**

In the medical field, good teamwork has been shown to improve medical outcome and quality of patient care [21, 22]; thus, healthcare professional educators have been implementing educational methods that promote teamwork. This includes TBL, a structured educational method that requires students to complete pre-work individually, attempt in-class activities individually (termed Individual Readiness Assurance Test) and then together in teams (termed Team Readiness Assurance Test), and solve application case studies as a team [23]. With an in-person TBL class, the benefits of a diverse team are manifested after 20–25 h of interaction [24]. In addition, learners attending in-person TBL are more likely to have organic interpersonal interactions and team building events after lessons. Team cohesion is crucial to the TBL process, as it was shown to be a significant predictor for team academic performance [25]. In a completely online TBL environment, social activities that promote team cohesion are likely to be limited. Indeed, we have found that most students preferred in-person over online TBL, as it supported the in-person interaction with their team members that is crucial for team building (unpublished results; Table 1). Consistent with this notion, recent studies have also reported that teamwork and team dynamics were impacted in online classes, as reflected by reduced group deliberation, which is suggestive of potential conflict avoidance that could be detrimental to the learning process and team cohesion [7, 16, 17]. Therefore, it is critical to develop ways to support in-person team building, such as hybrid classes, whenever possible.

**Professional Identity Formation is Delayed in Online Classes**

Professional identity formation is also an important part of physicians’ development. Professional identity is a highly dynamic and multi-faceted process achieved through socialisation with peers and mentors, and influenced by interactions with patients in the clinical setting [26–29]. Given that being part of the community of practice is fundamental for professional identity formation [30, 31], concerns were raised when medical students were temporarily removed from the clinical training environment during the COVID-19 pandemic [32]. By extension, the social isolation due to online learning can affect preclinical students’ sense of belonging to the greater community of practice. During the pandemic, majority of online classes placed greater emphasis on the continuity of medical education, i.e. discipline knowledge, rather than on fostering communities of practice [33]. Thus, the limited opportunities for engagement in informal observation and being part of the community of practice when immersed in online classes are perceived to impact professional identity formation [18]. Recent qualitative studies also showed that students, who transitioned to an online learning environment, experienced various disruptions to the facets of formal, informal, and hidden curricula that are critical in facilitating professional identity formation [19, 20]. In essence, online learning had changed their interaction with faculty, role models, and peers. Students noted that real human interaction was an irreplaceable part of the socialisation process, which was important in promoting professional identity formation [20]. Indeed, medical educators have thus called for “reimagining” of professional identity and innovative ways to support professional identity formation during the pandemic [34, 35]. Hence, to strengthen the process for medical students to “think, act, and feel like a physician”

Table 1 Students’ feedback showing preference for in-person opportunities. The first two comments were representative of students supporting hybrid TBL classes, and the last two comments were representative of students who preferred in-person TBL over other learning environment

| Feedback | Summary |
|----------|---------|
| “A hybrid class let me enjoy both benefits: social with others in class and more focused at home for self-learning” | |
| “I think the balance right now is ideal. I feel like I get good peer interaction in school, and this carries over to maintaining good team work and a good learning experience even online.” | |
| “It is easier to concentrate when physically surrounded by classmates focusing on doing the same thing. Also it is easier to discuss and clarify with classmates in person” | |
| “I find I am easily distracted during online TBL, and miss a lot of information. In face-to-face, I tend to pay attention more often, and feel more invested in the class.” | |
In [36], we advocate for including some form of in-person education, even during the pandemic.

Implementation of Hybrid Classes has its Challenges, but is Feasible

Given the importance of team dynamics and professional identity formation for healthcare professional students, we wanted to bring our preclinical students, who were doing only online learning, back to the classroom as soon as possible. However, the prevailing pandemic guidelines and social distancing requirements limited the implementation of typical TBL lessons, where the full class was accommodated for in a single venue. We overcame this by adopting a synchronous, hybrid TBL class format, where half the class was physically present and the other was connected via an online platform, on a rotating basis. This innovative solution provided the opportunities for interpersonal interactions, teamwork building, and professional identity formation, whilst adhering to the safe distancing measures in a limited classroom space.

During our hybrid class implementation, we faced several challenges. This included unequal opportunities across students to attend in-person classes due to a combination of venue capacity limitations and timetable scheduling. We also often faced audio feedback interference during the initial sessions due to unintegrated audio-visual systems for the in-person venue and the video-conferencing platform. Additionally, as a faculty member facilitating the discussions, we found ourselves occasionally neglecting the additional sources of input in a hybrid class. By working closely with the faculty members, students, and administrative staff and acting on their feedback, we overcame the challenges of implementing a hybrid TBL class. Our efforts were validated when the feedback from our students, who underwent the hybrid sessions, showed that they welcomed the opportunity to interact with their peers and build their teams’ relationship (Table 1). This is consistent with previous studies which showed students’ overall preference for in-person TBL [7, 8]. Overall, a majority of students welcomed the in-person opportunities (Table 1). It supported the greater sense of belonging and inclusion of the community of practice, all of which are key elements in gradual development of professional identity formation [27, 36].

Of note is that the changes from an online TBL to hybrid TBL are not prohibitive, as they require many of the same resources (Table 2). Thus, we have distilled our experiences into five practical tips for educators looking to implement a hybrid TBL class in their own setting. It should be noted that these tips are primarily for educators who teach large-sized classes and can only accommodate limited students in a single venue on a rotation basis.

| Resources                              | TBL phases utilising the resource | In-person TBL | Online TBL | Hybrid TBL |
|----------------------------------------|----------------------------------|---------------|------------|------------|
| Pre-work reading assignments           | Pre-class                        | ✓             | ✓          | ✓          |
| TBL–supported software                 | IRAT and TRAT, application       | ✓             | ✓          |            |
| Audio-visual system                    | IRAT and TRAT, application, facilitated discussion | ✓             |            |            |
| Timekeeping tool viewable by the whole class | IRAT and TRAT, application | ✓             |            |            |
| Platform for group discussions to take place | TRAT, application               | ✓             |            |            |
| Collaborative tools                    | Clarification phase              | White board, flip charts | Online stickie note or Kanban board tools | Online stickie note or Kanban board tools |

IRAT Individual Readiness Assurance Test, TRAT Team Readiness Assurance Test

Zoom™ as our primary mode of video-conferencing platform. This video-conferencing platform allows students to go into virtual rooms, called “breakout rooms”, for their group discussions. For collaborative tools to be used during the clarification phase, although Kanban boards are primarily used for project managements to visualise workflows [43], we found that the use of stickie notes or cards, and columns in these boards, made this tool very suitable when assigning questions to various teams during the clarification phase. There are several free-to-use Kanban board tools available on the internet.
Tip 1: Create a Class Rotation List

When the classroom venue is unable to accommodate all the students, and you need to divide the class according to the venue’s capacity limit, creating a rotation schedule will help to ensure that all students get an equal chance to attend in-person lessons. For instance, at Duke-NUS Medical School, our class size is 72, and to adhere to social distancing requirements, we are only able to accommodate 38 people in the room. Hence, we divided the class into two sections, and students were able to meet their teammates in person during every other TBL lesson.

Tip 2: Setting Up the Venue with a Centralised Audio-Visual (AV) System

Hybrid TBL lessons are run using the same video-conferencing tool and TBL-supported platform as an online TBL lesson (Table 2). Thus, all students will complete the readiness assurance and applications using the same tools, no matter if they are in person or remote. However, the key to successfully run a hybrid class is having a centralised AV system at the venue. Given that all those in class will be signing into the video-conferencing platform on their own devices, the multiple input and output audio from the various devices will generate audio feedback interference. This can be avoided by having a centralised input and output audio channel at the class venue, with students’ personal microphone and speaker of their laptops muted at all times. However, there is still the issue of getting the voices of the students in the classroom to be heard by those online. There are two ways to address this.

1. Provide microphones for each student or each group of students, which feed into an administrative laptop that is connected to the video-conferencing platform. The downside when using microphones at the venue is that those who are physically present will not be spotlighted, a feature in Zoom™, when they speak, as the input is channelled via the administrative laptop. So, it can be difficult for those joining in remotely to identify the speaker at the physical venue. This can be easily addressed by asking students at the venue to identify themselves prior to speaking.

2. If microphones are not available, an equally effective solution will be to retain a centralised audio output, e.g. an administrative laptop connected to speakers at the venue, whilst students and facilitators use the microphones on their own devices that are connected to the video-conferencing platform. So long as those at the physical venue keep their speakers silent at all times, and unmute to speak and mute immediately after, students at both sites will still be able to contribute to class discussions synchronously and with minimal occurrences of audio feedback interference.

Tip 3: Faculty to be Present in Person if Possible

In a hybrid TBL class, we strongly recommend that at least one faculty member be physically present in order to create an in-person social presence. With the implementation of online TBL, we needed to consider the three pedagogical elements of the “community of inquiry” model for learning in an online education experience: teaching, cognitive and social presence [37]. Whilst these elements are supported by TBL, even when carried out online, due to the inherent structure and format of TBL, the social presence can be augmented if the faculty is physically present in a hybrid class. Additionally, this also creates opportunity for professional socialising and mentoring which are keys for effective professional identity formation [38].

Tip 4: Familiarise with the Increased Avenues of Synchronous Inputs During a Hybrid TBL Facilitated Discussion

The faculty member facilitating a synchronous hybrid class has to adjust the facilitation strategy due to the increased avenues of communication present. In an online TBL class [39, 40], the facilitator has to pay attention to students’ input via the video-conferencing platform, such as the verbal discussions and the chat box. Whereas, in hybrid arrangements, there are the additional elements of in-person queries and non-verbal cues. Hence, the facilitator needs to be more deliberate in navigating the class discussion to ensure that groups on either side have an equal opportunity to be heard. Intentionally incorporating comments from the online chat, and non-verbal cues from the in-person cohort into the class discussion, will go a long way in creating a sense of inclusion and an engaging discussion for both groups of students.

Tip 5: Frequent Check-ins with Students

As there is an increased number of moving parts that need to fall in place for a successful hybrid TBL class to happen, the faculty member should build in regular check-ins with both cohorts of students. For example, prior to the facilitated class discussion, the faculty member should check for audibility at both sites. Delay is also expected when managing the various inputs, especially when technical glitches occur. Hence, it is important to ensure open lines of communication, so that both groups of students are aware of what is happening and do not feel left out.
**Optional Tip: Strict Adherence to Safety Management Measures**

Whilst this tip applies only to running a hybrid class during a pandemic, the occurrences of global pandemics are likely to increase [41, 42], hence making this tip relevant. In Singapore, to prevent the spread of COVID-19 due to prolonged contact in an enclosed space, all students attending TBL in person must adhere to the following governmental and university requirements: (1) students must complete a health declaration prior to entering campus; (2) students must complete the in-class attendance system and activate the contact-tracing application; (3) if feeling unwell, students must inform administrative staff and stay home if they, or anyone in the household, are unwell with COVID-19 symptoms; (4) students must wear a mask at all times; (5) students must sanitise their hands frequently and must sanitise the work area at the end of each day; (6) students must maintain safe distancing of at least one metre at all times; (7) students do not intermingle with classmates who are designated to a different section of the class on the rotation roster. Sufficient administrative support is required to monitor these safety measures if similar safety measures are required at your institution.

**Concluding Remarks**

This synchronous hybrid TBL format came about as we strove to adjust and innovate, so as to provide an improved learning experience for our students, whilst strictly adhering to prevailing social distancing measures. We wanted to minimise the sense of isolation that our students would experience due to prolonged remote learning, which in turn would negatively impact their team dynamics and professional identity formation.

Whilst this hybrid arrangement of classes is borne out of necessity due to the prevailing pandemic, it remains relevant post-pandemic as it opens up possibilities for more engaging educational activities. Indeed, economic and intellectual benefits can be seen with conferences that cater to a greater number of participants, when not limited by physical presence. Last but not least, the COVID-19 pandemic will not be the last one that educators and students experience. Hence, we believe that these tips will continue to be useful for educators looking to implement a hybrid arrangement of synchronous TBL classes beyond the COVID-19 pandemic.

**Acknowledgements** The authors acknowledge the unwavering support from Associate Professor Lai Siang Hui (Preclinical Assistant Dean), Professor Hwang Nian Chih (Body and Disease Course Director), and Professor Scott Compton (Associate Dean for Medical Education) in the swift adaptations of the preclinical curriculum. The authors would also like to acknowledge the education administrative team (Ms. Goh Sok Hong, Mr. Foo Ke Xiang, Ms. Alia binte Dhaifier, Ms. Avery Soo Yee Ng, Mr. Francis Kim Huat Law, Mr. Andy Guanghui Toh, Ms. Charmaine Jia Min Teo, and Ms. Chew Ting Puah) for their efforts in transitioning and adapting our innovations during the COVID-19 pandemic. Data used in this manuscript was from another research study supported by the seed funding grant from ALSET, Institute for Applied Learning Sciences and Educational Technology at the National University of Singapore, awarded to ICJ Lee.

**Author Contribution** ICJL wrote the first draft with significant input from PW, PW, SPLG, and SC critically reviewed and commented on the manuscript. All authors contributed to the manuscript revision. All authors read and approved the final manuscript.

**Funding** Data used in this manuscript was from another research study. The research study was supported by the ALSET seed grant programme provided by the NUS Office of the Senior Deputy President & Provost and the NUS Institute for Applied Learning Sciences and Education Technology.

**Declarations**

**Ethics Approval and Informed Consent** Informed consent was obtained from all individual participants.

**Conflict of Interest** The authors declare no competing interests.

**References**

1. Binks AP, et al. Changing medical education, overnight: the curricular response to COVID-19 of nine medical schools. Teach Learn Med. 2021;1–9.
2. Jumat MR, et al. From trial to implementation, bringing team-based learning online—Duke-NUS Medical School’s response to the COVID-19 pandemic. Med Sci Educ. 2020;30(4):1649–54.
3. Lim E, et al. The challenges of “continuing medical education” in a pandemic era. Ann Acad Med Singapore. 2009;38(8):724–6.
4. Ashokka B, et al. Coordinated responses of academic medical centres to pandemics: sustaining medical education during COVID-19. Med Teach. 2020;42(7):762–71.
5. Dickler, J. More than 30 colleges now say Covid vaccines will be mandatory for fall 2021. 2021 23 April 2021 20 June 2021; Available from: [https://www.cnbc.com/2021/04/23/these-colleges-now-say-covid-vaccines-will-be-required-for-fall-2021.html](https://www.cnbc.com/2021/04/23/these-colleges-now-say-covid-vaccines-will-be-required-for-fall-2021.html).
6. Brooks DC, Solheim CA. Pedagogy matters, too: the impact of adapting teaching approaches to formal learning environments on student learning. New Dir Teach Learn. 2014;137:53–61.
7. Franklin AS, Markowsky S, De Leo J, Normann S, Black E. Using team-based learning to teach a hybrid pharmacokinetics course online and in class. Am J Pharm Educ. 2016;80(10):171.
8. DeMasi J, Harvan RA, Luca M. Online and in-class team-based learning in undergraduate immunology: a comparative analysis. Med Sci Educ. 2019;29(4):1193–9.
9. Ali NS, Hodson-Carlton K, Ryan M. Students' perceptions of online learning: implications for teaching. Nurse Educ. 2004;29(3):111–5.
10. Alghamdi AA. Impact of the COVID-19 pandemic on the social and educational aspects of Saudi university students' lives. PLoS ONE. 2021;16(4):e0250026.
11. Baczek M, et al. Students’ perception of online learning during the COVID-19 pandemic: a survey study of Polish medical students. Medicine. 2021;100(7):e24821.
12. Parrish CW, Guffey SK, Williams DS. The impact of team-based learning on students’ perceptions of classroom community. Act Learn High Educ. 2021. [https://doi.org/10.1177/14697874211035078]

13. Cao W, et al. The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Res. 2020;287:112934.

14. Sundarases S, Chinna K, Kamaludin K, Nurunnabi M, Baloch G, M. Khoshaim HB, Hossain S, Sukayt, A. A Psychological impact of COVID-19 and lockdown among university students in Malaysia: implications and policy recommendations. Int J Environ Res Public Health. 2020;17(17):6206. [https://doi.org/10.3390/ijerph17176206]

15. Lyons Z, et al. COVID-19 and the mental well-being of Australian medical students: impact, concerns and coping strategies used. Australas Psychiatry. 2020;28(6):649–52.

16. Goi J, et al. Is teamwork different online versus face-to-face? A case in engineering education. Sustainability. 2020;12(24):10444.

17. Wildman JL, et al. Student teamwork during COVID-19: challenges, changes, and consequences. Small Group Res. 2021;52(2):119–34.

18. Lazarus M, R.S. Digital learning and medical professional identity – are they compatible? 26 April 2021 1 November 2021]; Available from: https://lens.monash.edu/medicine-health/2021/04/26/1383113/digital-learning-and-medical-professional-identity-are-they-compatible.

19. Harvey, A., et al., ‘I don’t feel like I’m learning how to be a doctor’: early insights regarding the impact of COVID-19 on UK medical student professional identity. medRxiv. 2021.

20. Findyartini, A., et al., Exploring medical students’ professional identity formation through written reflections during the COVID-19 pandemic. Journal of Public Health Research. 2020;9(Suppl 1).

21. Hautz WE, et al. Diagnostic performance by medical students working individually or in teams. JAMA. 2015;313(3):303–4.

22. Manser T. Teamwork and patient safety in dynamic domains of healthcare: a review of the literature. Acta Anaesthesiol Scand. 2009;53(2):143–51.

23. Michaelsen LK, Sweet M. The essential elements of team-based learning. New Dir Teach Learn. 2008;2008(116):7–27.

24. Michaelsen LK, Knight AB, Fink LD. Team-based learning: a transformative use of small groups in college teaching. Centers for Teaching Excellence - Book Library 2004. https://digitalcommons.georgiasouthern.edu/ct2-library/199

25. Thompson BM, et al. Team cohesiveness, team size and team performance in team-based learning teams. Med Educ. 2015;49(4):379–85.

26. Sarraf-Yazdi S, Teo YN, How A, Teo YH, Goh S, Kow CS, Lam WY, Wong R, Ghazali H, Lauw SK, Tan J, Lee R, Ong YT, Chan N, Cheong C, Kamal N, Lee A, Tan L, Chin A, Chiam M, Krishna L. A Scoping Review of Professional Identity Formation in Undergraduate Medical Education. Journal of general intern medicine. 2021;36(11):3511–21. [https://doi.org/10.1007/s11606-021-07024-9]

27. Jarvis-Selingar S, Pratt DD, Regehr G. Competency is not enough: integrating identity formation into the medical education discourse. Acad Med. 2012;87(9):1185–90.

28. Cruess SR, Cruess RL, Steinert Y. Supporting the development of a professional identity: general principles. Med Teach. 2019;41(6):641–9.

29. Goldie J. The formation of professional identity in medical students: considerations for educators. Med Teach. 2012;34(9):e641–8.

30. Lave J, Wenger E. Legitimate peripheral participation. Situated Learn: LPP. 1991;29–43.

31. Wenger E. Communities of practice: learning, meaning, and identity. Cambridge university press; 1999.

32. Sullivan GM, et al. Medical education scholarship during a pandemic: time to hit the pause button, or full speed ahead. J Grad Med Educ. 2020;12(4):379–83.

33. Longhurst GJ, et al. Strength, weakness, opportunity, threat (SWOT) analysis of the adaptations to anatomical education in the United Kingdom and Republic of Ireland in response to the Covid-19 pandemic. Anat Sci Educ. 2020;13(3):301–11.

34. Stetson GV, Dhaliwal G. Using a time out: reimagining professional identity formation after the pandemic. Med Educ. 2021;55(1):131–4.

35. Stetson GV, Kryzhanovskaya IV, Lomen-Hoerth C, Hauer KE. Professional identity formation in disorienting times. Med Educ. 2020;54(8):765–766. [https://doi.org/10.1111/medu.14202]

36. Cruess RL, et al. A schematic representation of the professional identity formation and socialization of medical students and residents: a guide for medical educators. Acad Med. 2015;90(6):718–25.

37. Garrison DR, Arbaugh JB. Researching the community of inquiry framework: review, issues, and future directions. Internet High Educ. 2007;10(3):157–72.

38. Chin D, Phillips Y, Woo MT, Clemans A, Yeong PK. Key Components that contribute to professional identity development in internships for Singapore’s tertiary institutions: a systematic review. Asian Journal of the Scholarship of Teaching and Learning. 2020;10(1):89–113.

39. Wong P, et al., Redesigning team-based learning facilitation for an online platform to deliver preclinical curriculum: a response to the COVID-19 pandemic. MedEdPublish. 2020;9.

40. Lee IC, Peiyang JW, Bulchand, Sarada. An online undergraduate TBL course: challenges, tips and feedback. In TBLC Global Newsletter Special Edition 2 • Tips for Challenges in Online TBL. 2020, TBLC Global Newsletter.

41. Pandemics to increase in frequency and severity unless biodiversity loss is addressed. 2020 29 October 2020 21 June 2021]; Available from: https://en.unesco.org/news/pandemics-increase-frequency-and-severity-unless-biodiversity-loss-addressed.

42. Jones KE, et al. Global trends in emerging infectious diseases. Nature. 2008;451(7181):990–3.

43. Ohno T, Bodek N. Toyota production system: beyond large-scale production. Productivity press; 2019.

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