

Team-based self-directed learning enhanced students' learning experience in undergraduate surgical teaching

Sim Sze Kiat, MS (Neurosurgery), Myo Nyunt, FRCS, Sohail Mushtaq, FRCS

Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Kota Samarahan, Sarawak

ABSTRACT

Introduction: To evaluate the effectiveness of team-based self-directed learning (SDL) in the teaching of the undergraduate Year 5 surgical posting.

Materials and Methods: A quasi-experimental study was conducted to develop and administer a team-based SDL versus a conventional SDL to teach undergraduate surgical topics. One hundred and seventy-four medical students who underwent the Year 5 surgical posting were recruited. They were assigned to two groups receiving either the team-based SDL or the conventional SDL. Pre- and post-SDL assessments were conducted to determine students' understanding of selected surgical topics. A self-administered questionnaire was used to collect student feedback on the team-based SDL.

Results: The team-based SDL group scored significantly higher than the conventional SDL group in the post-SDL assessment (74.70 ± 6.81 vs. 63.77 ± 4.18 , $t = -12.72$, $p < 0.01$). The students agreed that the team-based SDL method facilitated their learning process.

Conclusion: The study demonstrated that the use of a team-based SDL is an effective learning strategy for teaching the Year 5 surgical posting. This method encouraged peer discussion and promoted teamwork in completing task assignments to achieve the learning objectives.

KEYWORDS:

Self-directed learning; team-based learning; undergraduate; surgical training

INTRODUCTION

Self-directed learning (SDL) is a learning process in which students take the initiative, with or without guidance from others, to formulate their own learning goals, select resources for learning, implement learning strategies and evaluate the outcomes achieved.¹ The learners are primarily responsible for identifying their learning needs and formulating learning objectives.² SDL encourages in-depth learning and thinking, prepares students for lifelong learning and improves knowledge retention more than traditional courses.^{3,4} In medical education, this allows students to keep abreast of the latest advancements in the world of medicine and helps them become better doctors.

However, despite the proven advantages of SDL over conventional teaching in medical education, the introduction of SDL into undergraduate medical curricula has faced many challenges. Many have found it difficult to precisely define SDL and implement SDL modules within the existing framework of medical education.⁵ The indiscriminate application of SDL principles and poorly prepared lecturers and/or students have at times led to resentment at the introduction of SDL rather than welcome.

The Universiti Malaysia Sarawak (UNIMAS) medical programme (Doctor of Medicine, M.D.) is a five-year undergraduate program. This program has adopted a fully integrated curriculum for the first two pre-clinical years that includes both problem-based learning (PBL) and SDL. In the subsequent three clinical years, the students undergo clinical rotations in multiple disciplines. SDL has also been introduced to the clinical postings for many years, including the surgical posting.

Students are exposed to a basic surgical posting in Year 3 and a final surgical posting in Year 5. The learning objectives of both surgical postings are clearly defined and well-structured according to Bloom's taxonomy and matched to the medical programme learning outcomes. The teaching and learning activities in surgical postings (Years 3 and 5) include both teacher- and student-centred learning strategies—for example, didactic lecture, bedside teaching, seminars (prepared and presented by students) and SDL. The essential topics in the surgical logbook are selected for SDL, but the students might not have the chance to observe all these procedures in operation theatres or wards due to tight posting schedules and the dynamic hospital environment.

Over time, it was noticed that most students were unable to appreciate the concept of SDL and, thus, performed unsatisfactorily on certain surgical topics in the end-of-posting exam. Thus, the current SDL activities may not enhance the learning process or fully achieve the learning objectives of surgical postings as stated in the course plan. Given the inadequacy of existing SDL offerings, the Department of Surgery has planned to adopt a team-based approach in the SDL sessions.

Team-based learning (TBL) is an instructional method that promotes problem-solving and teamwork.⁶ It involves teaching and learning in small groups and does not require large numbers of tutors. This learning strategy allows

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Corresponding Author: Sim Sze Kiat

Email: sksim@unimas.my

medical educators to provide students with a resource-effective, authentic experience of working in teams to solve real-life clinical problems.⁷ In this study, we implemented a structured team-based SDL in the Year 5 surgical posting and evaluated its efficacy in achieving the learning objectives.

MATERIALS AND METHODS

We conducted a quasi-experimental study from December 2020 to February 2022 at the UNIMAS Faculty of Medicine and Health Sciences. The study was approved by the Ethics Committee of the UNIMAS Faculty of Medicine and Health Sciences (Ethics Reference Number: FME/20/07).

Participants were recruited through convenience sampling. All students enrolled in Year 5 surgical postings were recruited (four rotations from Academic Years 2020/2021 and 2021/2022). Students from Rotations 1 and 2 were allocated to the Control group (conventional SDL), and the subsequent Rotations 3 and 4 were allocated to the Intervention group (team-based SDL). A total of 174 students participated in the study (86 in the Control group and 88 in the Intervention group). All students gave written informed consent before participating in the study.

All students enrolled in Year 5 surgical posting (four rotations) were eligible for inclusion except for those repeating the Year 5 surgical posting.

Both Control and Intervention groups sat for a pre- (first week of surgical posting) and post-SDL (last week of surgical posting) assessment. A list of reading resources was provided to both groups. Additional materials (selected reading materials and videos, team assignment for each SDL topic, short-answer questions) were provided only to the Intervention group.

One SDL topic was assigned for each week during the surgical posting for a total of seven topics:

Week 1: Laparotomy and Wound Closure (Indications, Complications, Procedural Steps, Anatomy of Abdominal Wall)

Week 2: Open and Laparoscopic Appendectomy (Indications, Complications, Procedural Steps, Types of Incision)

Week 3: Inguinal Hernia Repair (Indications, Complications, Procedural Steps, Anatomy of Inguinal Canal and Hesselbach's Triangle)

Week 4: Open and Laparoscopic Cholecystectomy (Indications, Complications, Procedural Steps, Fundamental Knowledge on Endoscopic Surgery)

Week 5: Endoscopic Retrograde Cholangiopancreatography (Indications, Complications, Procedural Steps, Methods of Stone Removal)

Week 6: Emergency Oesophagogastroduodenoscopy (Indications, Complications, Test for Helicobacter Pylori, Anatomy of Stomach Blood Supply)

Week 7: Local Anaesthesia (Indications, Complications, Procedural Steps, Anatomy of Abdominal Wall)

This study was designed according to the four essential principles of TBL outlined by Michaelsen et al.⁸: 1) The group of students must be properly formed and managed, 2) students must be made accountable for their individual and group work, 3) group assignments must promote both learning and team development and 4) students must have frequent and timely feedback. The study protocol is shown in Figure 1. During the first week of the Year 5 surgical posting, a pre-SDL assessment was conducted consisting of 35 best-answer questions. The lists of SDL topics and resources were then distributed to all the students. The learning objectives of each SDL topic were explained by the Posting Coordinator.

Students in the Control group (Rotations 1 and 2) used the conventional SDL. Specific SDL sessions were allocated in the posting time table. The students were allowed to complete the SDL activities either individually or in small groups and based on their own schedule planning. Students were intended to take the initiative to find the resources on the provided list or other resources in the library. Students were free to approach the lecturers at any time for clarification should they have any doubt about the topics.

In the Intervention group (Rotations 3 and 4), the students were divided into smaller sub-groups consisting of 5–6 participants (mixing strong and average students). The students were required to follow the SDL topic as assigned for each week. For each topic, the lecturers carefully selected a few educational materials (journal article, book chapter, or video) to be provided one week ahead through the eLearning platform with a set of assignments (short-answer questions related to the weekly topic). The students were required to read or view the materials first and then to meet up in a team (sub-group) to discuss the assignment.

The role of the assignment task in each SDL session was to enhance the learning process and apply reasoning and critical thinking. The discussion included only students; no lecturer was present. If there was any doubt, the students would approach the lecturer via WhatsApp message for clarification. Following the discussion, the students would submit the assignment, and the lecturer would check the answers and provide feedback. In the eighth week of the surgical posting, a post-SDL assessment was conducted. These were the same 35 best-answer questions as in pre-SDL assessment but were rearranged in a different sequence. At the end of this study, the scores on the pre- and post-SDL assessments were collected and compared between the conventional and team-based SDL groups.

A self-administered questionnaire was distributed to the students from the Intervention group to collect feedback regarding their learning experience with team-based SDL. The questionnaire was adapted from a previous study by Burgess et al.⁹ and included closed (using a 5-point Likert scale with 1 being 'strongly disagree' and 5 being 'strongly agree') and open-ended questions.

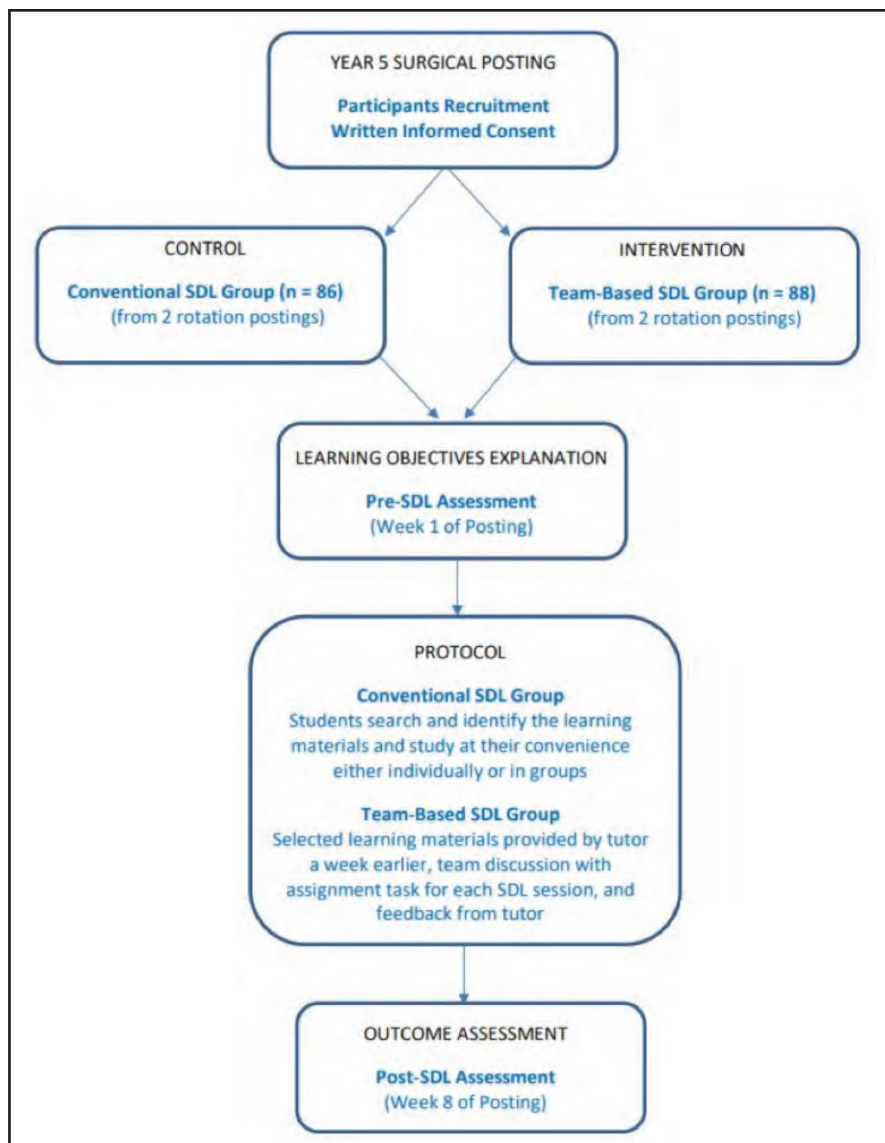


Fig. 1: The study protocol. SDL = self-directed learning

Statistical Analysis

The collected data were analysed using SPSS statistical software for Windows (v 22.0; IBM, Armonk, NY, USA). Quantitative data were analysed using descriptive statistics. Paired t-test was used to compare the mean pre- and post-SDL assessment scores in the study groups. An independent t-test was used to compare the mean post-SDL assessment scores between the Control and Intervention groups.

RESULTS

A total of 174 students participated in this study (Control group: 86 students; Intervention group: 88 students). There were no significant differences among students from any study groups in the mean pre-SDL assessment scores. After 8 weeks of posting, the mean post-SDL assessment scores were significantly higher than the pre-SDL scores in both conventional (63.77±4.18 vs. 46.56±6.05, t=-26.73, p<0.01)

and team-based SDL (74.70 ± 6.81 vs. 46.93 ± 4.93, t=-33.69, p<0.01) groups (Figure 2). This means that both conventional and team-based SDL strategies improved students' understanding of the selected surgical topics.

However, when comparing the effectiveness between the conventional and team-based SDL, the latter showed a significantly higher mean post-SDL assessment score than the SDL group (74.70±6.81 vs. 63.77±4.18, t=-12.72, p<0.01) (Figure 3); the team-based SDL group improved learning by 59.2% while the Control group improved learning by 37.0%. These results demonstrate that team-based SDL is a better learning strategy than conventional SDL.

Results from the self-administered questionnaire revealed that most students were satisfied with team-based SDL (Figure 4); all responses were 3 and above on the 5-point Likert scale.

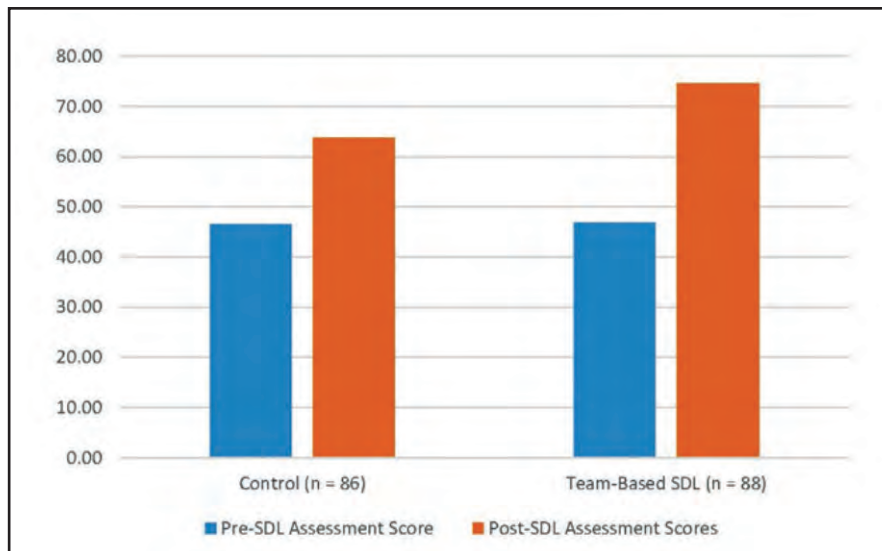


Fig. 2: Mean pre- and post-learning assessment scores in Control and Intervention groups. SDL = self-directed learning

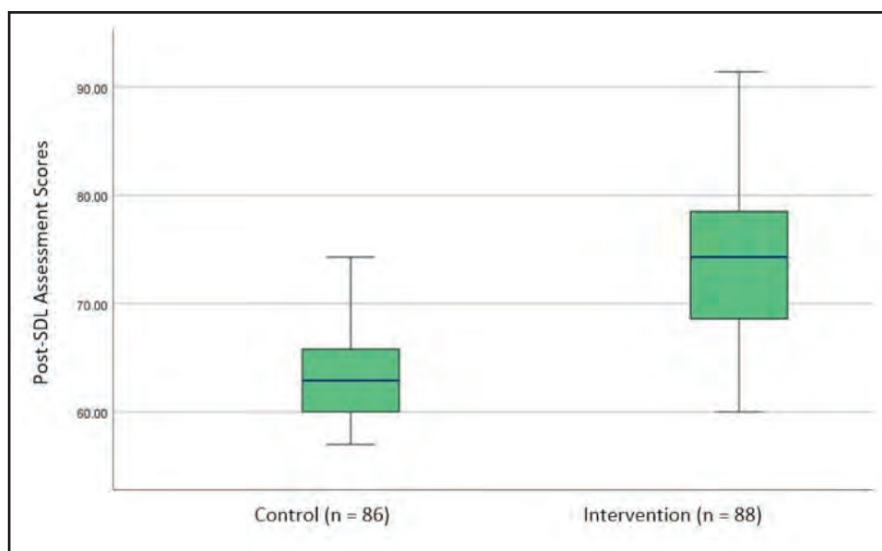


Fig. 3: Comparison of mean post-learning assessment scores between control and intervention groups. SDL = self-directed learning

DISCUSSION

The UNIMAS medical programme includes 9 weeks of study in one rotation of the Year 5 surgical posting with 40 student learning hours per week as required by the Malaysian Medical Council. Thus, the schedule for the undergraduate surgical posting is packed with various teaching and learning activities. One of these learning activities is SDL, and there are a total of seven SDL sessions in one rotation (average of one SDL session per week).

SDL is an important tool for transforming medical students into lifelong learners so that they are competent to identify their learning needs, allocate resources, and evaluate the learning process throughout their career.¹ The SDL approach is effective if the objectives are realistic and accomplishable, ensuring that learners can apply SDL modalities to situations in which they are required to learn by themselves.³ However, the success of SDL relies on self-discipline, independence, self-

evaluation and reflection. The readiness of the lecturers, the facilities available, and the types of learning subjects could also affect the success of SDL.

Several studies have demonstrated the value and effectiveness of SDL in pre-clinical teaching years—for example, in learning biochemistry, physiology and anatomy.^{2,4} However, the efficacy of SDL in some clinical courses is debated.⁵ Furthermore, without monitoring, students may lose interest in searching for correct and adequate information in their studies.

The UNIMAS Year 5 surgical posting has been adopting SDL for many years. The topics selected for SDL are the essential topics in daily surgical practice for their future internship. Successful SDL requires self-discipline and active involvement of the students in the learning process. Probably due to lack of motivation and inadequate search for information, the

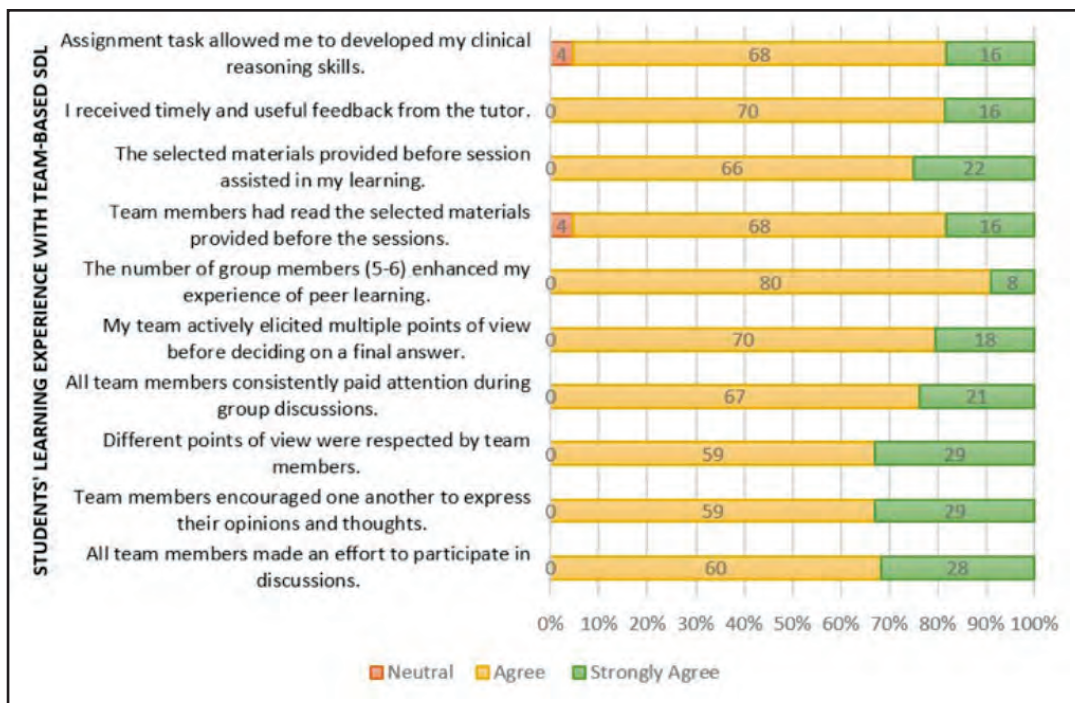


Fig. 4: Students' feedback on learning experience with team-based self-directed learning (SDL)

Table I: Comparison of the main characteristics of SDL, PBL and TBL

SDL	PBL	TBL
<ul style="list-style-type: none"> It prepares the students to be lifelong learners. Based on clear learning objectives, students identify their learning needs, search for information resources and self-evaluate the learning process. Facilitators may or may not be needed in the learning process. Self-discipline and active involvement of the students in the learning process are needed. 	<ul style="list-style-type: none"> It promotes problem-solving and interpersonal skills. A problem scenario is given to a group of students, and students must recall the existing knowledge to find new knowledge to solve the given problem for two or more sessions. There is usually no evaluation of the learning process. Facilitators are required in each small group, and the facilitators may not necessarily be content experts. Teamwork is needed to gather existing and new knowledge to solve the problem. 	<ul style="list-style-type: none"> It promotes problem-solving and interpersonal skills. Pre- and post-learning assessments are used. Pre-discussion materials and tasks are provided. Individual students will prepare the pre-discussion work, meet in a group for discussion and complete the tasks. Fewer facilitators are required. One facilitator can handle multiple groups and may not need to be physically present during the discussion. Peer evaluation is emphasised. Facilitators with knowledge in the learning topics are preferred. Peer monitoring motivates the learning process.

SDL = self-directed learning, PBL = problem-based learning, TBL = team-based learning

students in the existing SDL program were found to perform poorly on the end-of-posting exam with regard to these topics. To ensure that students can benefit from SDL and achieve the course learning outcomes, some modifications are needed.

In this study, we introduced the TBL approach into SDL. Based on the TBL pedagogy,^{8,10} there are certain important elements that must be applied for the successful conduct of team-based SDL: i) clear learning objectives, ii) well-selected learning resources (journal articles, book chapters and videos), iii) discussion in a small group with tasks to enhance the learning experience, iv) feedback from lecturer for

improvement and v) implementation of pre- and post-SDL assessment for SDL sessions to assess the learning outcomes.

TBL is relatively new in medical education, although it has been implemented in other educational curricula since 1970. It was first introduced by Professor Larry K. Michaelsen from the University of Oklahoma.⁸ In this learning approach, students are encouraged to develop higher-level group cohesiveness, which, in turn, increases their intellectual abilities in a particular subject. Like conventional SDL, TBL also has a different approach from PBL. According to Burgess et al.,⁹ TBL maintains the advantages of small-group teaching and learning, but, in contrast to PBL, it does not

require large numbers of tutors. Furthermore, the structure and format of the TBL sessions are more conducive to learning, engagement and participation than PBL sessions as pre-review of content is encouraged in TBL.

The advantage of TBL compared to the traditional modality of competitive and individualistic learning is that the small-group learning environment allows a greater sense of accomplishment, learning and application of reasoning and critical thinking among students.¹¹ The TBL approach motivates students to actively participate in their learning activities, providing social support for weaker students and improves their communication and interpersonal skills. Table I summarises and compares the main characteristics of SDL, PBL and TBL.

The recommended team size in the TBL approach is about 5–7 members. This is because the team must be large enough to maximise their intellectual resources and as heterogeneous as possible but also not so large as to prevent full participation by all team members. For this reason, we reviewed the academic results of the students in their pre-clinical years and previous clinical postings. We then identified the students with a cumulative grade point average (CGPA) above and below 3.0. The students were then randomly divided into smaller groups consisting of 5–6 students (depending on the number of students per rotation) with a mixture of students with high and average GPAs. The intention of this arrangement was to encourage fruitful discussion, hoping that the students with high GPAs would guide the average students in their study.

Our study demonstrated that team-based SDL improved the students' learning process and enhanced their understanding of the topics given better than conventional SDL. The students in the team-based SDL group scored 59.2% higher in their post-SDL assessment compared with 37.0% for the students in the conventional SDL group. One of the main advantages of team-based SDL over conventional SDL is peer support, which motivates and encourages students in active learning.

Previous studies have suggested that students taking initiative in the learning process and engaging in group discussions under the guidance of teachers to promote the students' self-motivated learning and teamwork are the key steps to success in the TBL approach.^{12,13} However, in our adoption, the lecturers did not attend the students' discussion. Based on our past experience, we suspected students might be afraid of offering ideas and would not actively participate in the discussion when the tutors were around. In our study, the students were allowed to form their discussions at their own convenience as agreed by the team members. The students were able to contact the lecturer-in-charge if they encountered any problems in their discussions by means of WhatsApp. Following the team discussion and completion of the assignment task, the students would then meet up with the lecturer-in-charge for a two-way feedback session. Most of the students found that this team-based SDL facilitated their learning process.

This study implies that the team-based SDL model is an implementable and more effective learning strategy in the teaching of undergraduate Year 5 surgical posting through peer motivation compared to SDL alone. This model is also a practical approach in the institutions with small numbers of teaching staff, since it does not require the presence of tutors during the students' discussion. In future, it can be introduced into the teaching of Year 3 surgical posting, as well as the teaching of other clinical postings.

In addition, this model may be applicable in teaching the local postgraduate clinical master programme. The local postgraduate clinical master programme is a 4-year residency clinical specialist training programme. The trainee must perform supervised specialist clinical work, conduct research and explore the latest information on the relevant speciality. Owing to the tight working schedule, a traditional teacher-centred teaching method may not be practical. Thus, team-based SDL may help the trainees by equipping them with updated medical knowledge through team discussion and allowing them to monitor each other's learning process without compromising their clinical services and research.

LIMITATIONS

There were a few limitations to the study. First, this was a single-centre study with the team-based SDL strategy applied only in the Year 5 surgical posting. Second, the content area covered was limited to seven SDL topics of a 9-week posting. Third, the intervention group was formed through convenience sampling with no randomisation. In view of these limitations, further studies are required to validate the findings of this study with crossover methodology and in other clinical postings.

CONCLUSION

Lack of motivation could impede the learning process in SDL. A structured team-based SDL that includes clear learning objectives, adequate and correct resources, peer discussion with assignment tasks and feedback from the lecturers could enhance the learning experience and improve the learning outcomes.

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