Original Article

Does Team Learning Motivate Students' Engagement in an Evidence-based Medicine Course?

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Abstract

Introduction: Small group-based instructional methods such as team learning have been shown to produce positive educational outcomes. To motivate students' learning in an evidence-based medicine course, we explore team learning as a teaching strategy, and describe students' engagement and preference for this mode of learning. Materials and Methods: An adaptation of team learning was implemented in September 2007 for all Year 2 Medical undergraduates attending the Principles in Evidence-Based Medicine course at the National University of Singapore. First, each student attempted a multiple-choice question individually. Next, the student discussed the same question with his/her team and provided a group response. Individual and group answers were recorded using keypads and Turning Point software. Students' engagement and preference for team learning were measured using a self-reported Likert Scale instrument. The pattern of engagement in team learning was compared with conventional tutorial involving the same cohort of students using χ^2 trend test. Results: A total of 224 (88%) and 215 (84%) students responded to the surveys on team learning and conventional tutorial respectively. Overall, students reported a higher level of engagement with team learning than conventional tutorial. However, regardless of the mode of instruction, the students were equally likely to pay attention in class. Sixty-nine per cent of students found team learning more enjoyable than conventional tutorial, with 73% preferring this mode of learning. There was a tendency for the percentage of correct responses to improve after group discussion. Conclusions: Team learning is the preferred mode of learning by Year 2 students attending the evidence-based medicine course. It promoted a high level of students' engagement and interaction in class.

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Key words: Group interaction, Individual accountability, Students' engagement

Introduction

Team-based learning (TBL) is a well-defined instructional strategy that has generated considerable interest within the medical education community because of its potential to promote active learning with a limited number of faculty facilitators.[1,2] This mode of learning was originally developed more than 20 years ago for college business and science courses.[3,4] Essentially, it allows a single instructor to manage multiple small groups simultaneously in a large class, where the class time is shifted away from learning of facts, to application and integration of information. The effectiveness of team-based learning as an instructional strategy is based on the premise that it nurtures the development of high levels of group cohesiveness, which in turn can produce a wide variety of positive educational outcomes.

Several studies have suggested favourable learning outcomes associated with team learning. Such benefits include increased student engagement, improved student attendance and learning attitude, higher-quality communication processes and better academic performances.[2,5-7] Publications describing the use of team learning in large-enrolment undergraduate courses have also suggested that it enables students to master the content while promoting team communication, content application, and individual and group accountability.[4] Besides, there have also been reports of faculty being positively influenced to use TBL because it helped students to think more critically and hence resulted in improvements in quality of in-class discussions.[1,8]

Three fundamental principles of team learning include (i) promoting individual and group accountability, (ii) adopting

practices that stimulate interaction within and between groups, and (iii) using assignments that link and mutually reinforce individual work, group work and total class discussions. In team learning, students must demonstrate individual and group accountability by preparing for group work, devoting their time and effort to complete group assignments, and interacting with one another in productive ways.[3] The lack of preparation on the part of individual hinders the development of group cohesiveness and breeds resentment of members who may be forced to carry the burden of their less able or motivated peers. On the other hand, preparedness ensures that every member is ready to contribute to the overall work of the team and hence foster greater cohesiveness. The development of appropriate group assignment is a critical aspect towards successful implementation of TBL. As such, team assignments need to be effectively designed to ensure that it truly fosters group interaction and promotes both learning and team development.

The 'pure' application of TBL includes repeated sequence of the following 3 phases:

(i) Phase I: Learners read and study material independently outside class;

(ii) Phase II: Learners complete an individual readiness assurance test (IRAT) to assess their basic understanding of facts and concepts learnt in Phase I. The same test is administered to pre-assigned team of 5 to 7 learners. The team forms a consensus about each answer in this group readiness assurance test (GRAT).

(iii) Phase III: Students work in teams on assignments that provide the opportunity to apply Phase I and II knowledge in real-world complex problems.

However, this method allows flexibility for instructors to use selectively one or more of the phases, depending on the contextual demands of the course. Such flexibility is especially important in medical education, because of the unique constraints inherent in many medical contexts.[1,9]

Thus, to motivate the learning of students in an evidence-based medicine course, we explore the implementation of Phase II of team learning instructional strategy, and describe students' engagement and preference for this mode of learning. The pattern of engagement that emerged in TBL was compared with conventional tutorial settings.

Materials and Methods

The undergraduate medical programme at the National University of Singapore is a 5-year course leading to the degrees of Bachelor of Medicine and Bachelor of Surgery (MBBS). Among other courses taught in the second year, the Year 2 programme also consists of lectures and tutorials on the Principles of Evidence-Based Medicine. This course aims to equip medical students with the skills to critically appraise evidence related to clinical practice in the medical literature.

In September 2007, we implemented an adaptation of team-based learning (Phase II only) in a tutorial of the Principles in Evidence-Based Medicine (EBM) course. This was conducted for the entire cohort of 256 Year 2 Medical undergraduates over 2 sessions, each lasting 2 hours. Each session involved a class size of about 100 students, and both sessions were jointly led by 2 tutors, BCT and WPK. By adapting Phase II of the TBL instructional strategy, the learners were first asked to attempt a multiple-choice question on his/her own and provide an individual response. This IRAT allowed the instructors to assess the students' basic understanding of facts and concepts taught in the lecture which was conducted a week earlier. After the IRAT, the students were asked to turn to his/her pre-assigned team of 5 students to discuss the same question and form a consensus about each answer. A group response was required for this GRAT. All teams in the class work on the same problem at the same time. Both individual and group answers for each of the series of 13 questions were recorded using keypads and the Turning Point software.

In keeping with the principles of TBL, the students received regular and timely feedback on both IRAT and GRAT. Following the individual and group response for each question, the proportion choosing each answer option was shown to the class for concrete and immediate feedback on how effective they have been using the intellectual resources of group members. While facilitating the TBL session, the instructors were also able to discuss each answer option with the students and clarified any misconceptions or misunderstandings before proceeding to the next question.

Additionally, we measured the students' level of engagement and preference for team learning using a self-reported Likert scale instrument. In particular, the students' self-report of engagement measure was adapted from a study measuring student engagement in health profession settings.[10] Through these questions, we sought to quantify students' participation and attentiveness, as well as their level of involvement in class.

The students' level of engagement in TBL was later compared with a control setting of conventional tutorials (involving the same cohort of students, but covering different EBM topics) led by the same 2 tutors in the following 2 weeks. The class size of these conventional tutorials was much smaller, approximately 30 each. Typically, conventional tutorials involved didactic-based teaching, and learners generally value content over interaction with peers or tutor. Often, the instructor has to pick on students by name to answer the questions, or to prompt for variation in answers.

Comparisons of students' pattern of engagement between TBL and conventional tutorial were made using the χ^2 trend test. All statistical evaluations were conducted using SPSS 15.0, based on a 2-sided test assuming a 5% level of significance.

Results

A total of 224 (88%) and 215 (84%) students responded to the surveys that were administered during the TBL and conventional tutorial settings respectively. Overall, students reported a higher level of engagement during the TBL tutorial (Table 1). Eighty per cent of students indicated that they had participated in class discussion during TBL as compared with 58% for the conventional tutorial (P <0.001). Similarly, 73% of those in TBL reported that their classmates were actively involved in class as compared with 57% for conventional tutorial (P <0.001). For the individual, there was also a tendency towards being a more active learner in TBL (76%) as compared with conventional (66%) tutorial (P = 0.006). Not surprisingly, students attending the conventional tutorial were more likely to report having a chance to share their answers or have their questions addressed (70% versus 62%, P = 0.061). However, regardless of the mode of tutorial, the students were equally likely to pay attention in class.

With regard to students' perception in learning, a notably higher proportion of students in the conventional tutorial (78% versus 55%) thought that the tutor's answers and comments contributed most towards their learning as compared with TBL (Fig. 1). Contrastingly, an appreciable number of students in TBL indicated that they learnt most from their own discovery or other classmates' contribution during the tutorial.

Sixty-nine per cent of students found team learning to be more enjoyable than conventional tutorial. Of those who preferred team learning (73%), the primary reasons were it involved more active learning (36%), it was less intimidating (16%), there was wider scope of discussion (14%) or they learnt more from classmates (14%) (Fig. 2). Amongst those who did not like this style of learning, the main reasons were: students preferred learning directly from the tutor (20%), the teaching method was too time-consuming (20%) or TBL was not seen to be more effective than conventional tutorial (20%).

Generally, there was a tendency for the percentage of correct responses to improve after group discussion (Table 2). For students who attended Session 1 of the TBL tutorial, improvements in percentage of correct answers was seen in 10 out of 13 questions administered. Similarly, for students who attended Session 2 of the TBL tutorial, improvements in percentage of correct answers were seen in 8 out of 13 questions administered.

Discussion

Team learning stimulates an energetic, total-class discussion with teams forming a consensus in their answers and the instructors helping to consolidate and focus learning. It brings together theoretically-based and empirically-grounded strategies to foster the effectiveness of small groups working independently in large classes with high student-to-faculty ratio while reaping the benefits of faculty-led small group discussions.[11] The implementation of the team learning method ensured individual accountability and promoted team work, and this has been known to be associated with a wide variety of positive educational outcomes.[2,5-7]

In this study, we explored TBL as an instructional strategy, and collected valuable data to guide informed choices with regards to the adoption of TBL in an EBM course. For most of our students, team learning represented a novel approach of classroom instruction. Consequently, at the start of the session, it was essential to focus on clarifying the team learning framework, RAT processes and expectations of group collaborations. During individual RAT, the students worked quietly to record their answers. However, the lecture theatre was bustling with noise and activity during team RAT, and it appeared that most students were on tasks and participating in team discussion.

A measurable evidence of this group activity was the improvement in group over individual performance scores.

Table 1. Students' Self-report on Level of Engagement during TBL and Conventional Tutorials

Engagement behaviour	TBL (n = 224)			Conventional (n = 215)			*P* value
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	
Participate in class	178 (79.5)	34 (15.2)	12 (5.3)	125 (58.1)	58 (27.0)	32 (14.9)	<0.001
Paid attention in class	196 (87.5)	19 (8.5)	9 (4.0)	183 (85.5)	24 (11.2)	7 (3.3)	0.780
Active learner	170 (75.9)	46 (20.5)	8 (3.6)	141 (65.9)	53 (24.8)	20 (9.3)	0.006
Class actively involved	162 (72.6)	46 (20.6)	15 (6.7)	122 (57.0)	48 (22.4)	44 (20.6)	<0.001
Had chance to share answer or have questions addressed	138 (61.6)	65 (29.0)	21 (9.4)	149 (70.3)	49 (23.1)	14 (6.6)	0.061

TBL: team-based learning

Table 2. Percentage of Correct Response and Improvement after Group Discussion

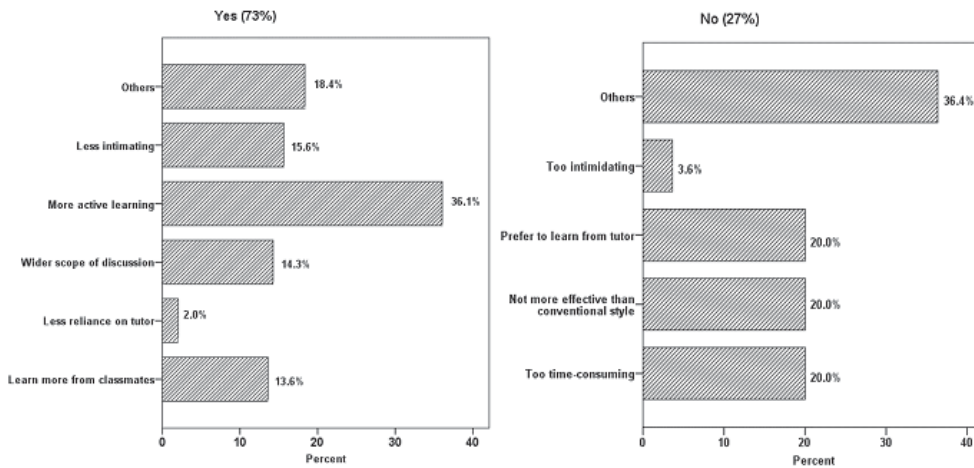| Question	Session 1			Session 2		
	Individual	Group	Improvement	Individual	Group	Improvement
1	51	100	96.1	41	79	92.7
2	46	47	2.2	46	35	-23.9
3	86	89	3.5	67	78	16.4
4	62	52	-16.1	71	76	7.0
5	64	79	15.0	85	100	17.6
6	61	90	47.5	64	72	12.5
7	96	100	4.2	98	91	-7.1
8	90	100	11.1	83	82	-1.2
9	51	67	31.4	41	39	-5.1
10	95	93	-2.1	98	100	2.0
11	100	100	0	94	100	6.4
12	90	94	4.4	96	91	-5.2
13	74	78	5.4	67	100	49.3
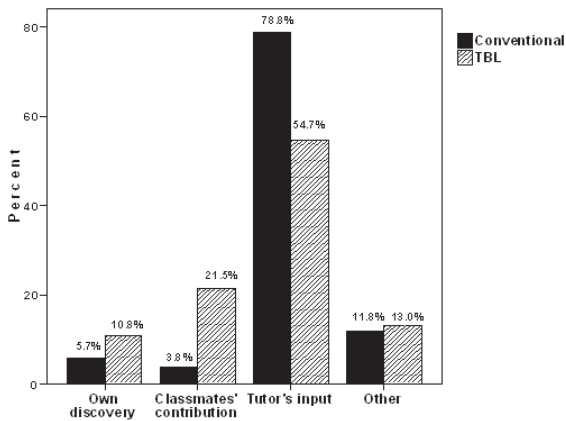
Fig. 1. Students' perception of learning.

Such pattern of improvement in scores was also observed by Michaelsen et al.[12] who reported that in the majority of classes, the lowest team score was higher than the best individual score in the entire class. Consistent with other studies,[2,5-7] we have also demonstrated other positive educational outcomes such as improved pattern of student engagement with this mode of learning. From the economical and logistical perspective, we have effectively reduced the number of teaching sessions from 8 conventional tutorials (each of 2 hours) taught by 2 tutors, to 2 TBL sessions of the same duration conducted by the same 2 tutors. Thus, the management of multiple small groups simultaneously in a large class via TBL not only saved manpower and time, but also reduced tutor fatigue. Based on the conventional setting, each tutor would have to repeat the same tutorials 4 times, and by the time of the 4th session, tutor fatigue might be evident. Unconsciously, this might affect the

Fig. 2. TBL as the preferred mode of learning.

learning of students especially in the last group.

Although faculty attitude and perceived outcomes were vital to the successful implementation of new innovations such as TBL, the attitude of learners, class size, content density and structure of the course were also influential factors. In particular, the EBM topic which we had chosen for implementing TBL instructional strategy was especially well-suited for RATs which typically consisted of short multiple-choice questions for assessing students' understanding of key concepts.

In their study identifying enablers and inhibitors associated with the use of TBL, Thompson et al[1] reported that the support and co-ordination at the administrative and technical level also affected the adoption of TBL. The positive outcome of our study was in part attributed to the support of our technical staff who ensured that the hardware and software were functioning well, and the administrative staff who not only helped to organise the students into groups, but also sent reminders to students to bring their keypads so that the individual and group responses could be recorded without any hassle. These findings were reflective of a research which also suggested that programme users (faculty) and the environment (curriculum, students, administrative and support staff) were all vital to the successful adoption of new innovations such as TBL.[13]

There are limitations in this study. Firstly, we did not perform a paired comparison although the 2 modes of learning were implemented on the same cohort of students at different times, Logistically speaking, this was not feasible. Besides, we wanted to maintain anonymity, in order to allow students to freely express themselves when rating their level of engagement in class. Hence, the evaluation forms were not identified to link the responses from the 2 modes of learning. Despite having lower power as compared to a paired comparison, we nevertheless observed notable differences in the level of engagement between the 2 groups in 3 aspects. Assuming a comparison based on independent groups, the existing study would have at least 90% power to detect a difference between methods with regard to students' participation and active involvement of classmates during lesson. With regard to being an active learner, there is at least 60% power to detect the observed difference assuming independent groups.

Individual pre/post quizzes were not conducted in the conventional tutorials to determine the amount of learning that might have taken place. As such we were not able to assess whether conventional tutorial has contributed to an improved understanding of the lectures.

Although the results of this study encourage the use of TBL to enhance student engagement in an EBM course, the successful implementation of this new innovation was partly due to the specific topic that we have chosen. This topic was particularly well-suited for RATs, where multiple-choice questions were used to assess students' understanding. As such, our findings cannot be generalised to other EBM topics or courses that are not amenable to assessing students' learning via a series of multiple-choice questions.

Despite these limitations, team learning has generally served as a useful framework, in enabling our cohort of 256 students to move away from didactic instruction to small-group experiences without increasing faculty involvement in the EBM course. Despite the shift in burden of content-learning to students through individualised learning and group discussions, we found most students to have had achieved their learning objectives in this exploration. Encouraged by the response of this study, we have continued to implement this mode of learning for our EBM course involving the same topic in academic Year 2008/9.

Conclusions

Team learning is the preferred mode of learning by Year 2 students attending the evidence-based medicine course. This active learning mode promoted a high level of students' engagement and interaction, and encouraged student-directed learning.

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