ORIGINAL CONTRIBUTIONS

EVALUATION OF A MODIFIED TEAM BASED LEARNING METHOD FOR TEACHING GENERAL EMBRYOLOGY TO 1ST YEAR MEDICAL GRADUATE STUDENTS

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ABSTRACT

BACKGROUND AND AIMS: *To encourage student participation in the learning process, the authors introduced a modified team based learning (TBL) method to cover two general embryology topics in the 1st year MBBS curriculum. The aim of this study was to evaluate students' perception of this method vis-à-vis the lecture method of teaching.* ***SETTINGS AND DESIGN:*** *A questionnaire was used to survey and evaluate the perceptions of 1st year MBBS students at the Department of Anatomy at our medical college in India.* ***MATERIALS AND METHODS:*** *A total of eight classes were allotted to cover General Embryology. Six of these classes were conducted using the traditional didactic lecture method. Two topics were covered using the modified TBL method. Five teams of students were constituted, and each team was given handouts which contained basic factual material, four clinical case histories, and previous university exam questions from the topic. On the day of the session, these were discussed in the presence of the faculty facilitator. Students evaluated these sessions through a questionnaire.* ***RESULTS:*** *A majority of students felt that the modified TBL sessions were better at fulfilling learning objectives (46 students, 85%), enabled better understanding (43 students, 79%), were more interesting (43 students, 81%), ensured greater student participation (51 students, 94%) and involved greater effort on the part of students (53 students, 98%), as compared to traditional teaching methods. Most of the students (43 students, 79%) opined that more such sessions should be organized in the future.* ***CONCLUSIONS:*** *Responses from students show that the modified TBL classes could be utilized judiciously along with the traditional didactic lectures for teaching embryology.*

Key words: *Didactic lectures, embryology teaching, modified team based learning*

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INTRODUCTION

The curriculum prescribed by the affiliating University allocates 650 hours for anatomy teaching. Out of this, 160 hours are meant

for theory classes. The rest of the time is to be utilized for practical sessions, tutorials and group discussions. The University rules specify the number of hours but do not restrict how these sessions are conducted. Traditionally, the lecture method has been used for theory classes. This method however has certain drawbacks.[1] The important role of clinical application, active learning and group problem solving in learning has come to be recognized.[1-7] One of the newer methods to develop these skills is the team based learning (TBL) method, first introduced by Michaelsen for teaching large classes in business schools.[8]

Problem based learning (PBL) has been used widely as a student-centered, active learning approach to teaching and has been well studied.[1,7,9] Team based learning is a relatively more recent active learning strategy employed in medical education.[10-14] Many of the changes that are required in the curriculum for the implementation of active learning methods are common to most approaches. Team based learning is a student-centered but instructor-led method of learning. Both individual as well as team accountability processes are incorporated into this method in which students have to work in teams to solve problems. The method employs strategies to incorporate the effectiveness of small group learning methods like PBL into large-group lecture oriented sessions. The essential components to this strategy include advance preparation, team formation, readiness assurance testing, group application exercises and peer evaluation.[8,15]

This method was adapted in a limited manner at Baylor College of Medicine for use in basic science and postgraduate medical education.[11] Later, this method was more extensively used in a medical gross anatomy and embryology course at the Wright State University School of Medicine, with encouraging results.[12] A modified TBL method has been effectively implemented in teaching pathology to undergraduates at St. George's University, Grenada, West Indies.[14] The effective use of TBL requires redesigning a course from beginning to end, with the planning starting well before the start of the term. This is not possible at present in India because of the way the medical curriculum is structured. However, a modified TBL method as described by Bhusnurmath[14] can be utilized for selected topics to replace the traditional lecture method.

At the medical college where the authors work, embryology classes for 1st year MBBS students are usually taught using the traditional lecture method. In an endeavor to encourage student participation in the learning process, a modified TBL method to cover two general embryology topics was introduced. Students evaluated these sessions using a questionnaire with a Likert five-point grading system, devised by the authors. The current article describes the implementation of the modified TBL method as described by Bhusnurmath,[14] its evaluation, and discusses the results.

MATERIALS AND METHODS

A total of eight classes were allotted to cover General Embryology over a period of eight weeks (August and September, 2007). Each class was of one hour duration, covering a specific topic. Six of these classes were conducted using the traditional didactic lecture

method. Two classes, i.e., 'Gametogenesis and the Menstrual Cycle' and 'Formation of Fetal Membranes and the Placenta' were conducted using the modified TBL method, hereafter referred to as TBL sessions. These two topics were selected for the modified TBL sessions because of their tremendous clinical importance. All eight classes were handled by the same faculty member, the corresponding author.

One week prior to the first modified TBL session, the 60 students (30 male and 30 female) of the 1st MBBS batch were randomly distributed into five groups, each group consisting of 12 students. The modified TBL procedure was explained to them. The same groups were retained for the second session as well. One week prior to each session, each group was given handouts which contained the following: 1) learning objectives; 2) basic factual material concerning the topic; 3) four clinical case histories (numbered 1 to 4), each with five related questions; 4) the previous university exam questions covering the topic; and 5) references.

The clinical case histories were numbered in a logical sequence, concerning such topics as would be covered in a traditional lecture. The five questions that followed each case history were framed in such a way as to cover, as far as possible, all important material related to that topic. Given below is an example of a clinical case history in the first session:

A 17-year-old lady complained of moderately severe lower abdominal pain around the time of menstrual bleeding. The pain was cramping in nature and intermittent. She was diagnosed to have dysmenorrhea by her doctor, who prescribed analgesic and anti-spasmodic tablets.

Questions:

What is the most probable cause of the abdominal pain?

Name the phases of the menstrual cycle.

Name the layers of the endometrium.

Describe the changes occurring in the uterine endometrium during the menstrual cycle.

Briefly describe the mechanism by which hormones regulate the menstrual cycle.

Each team had to be ready with answers to the questions pertaining to the case history as well as the university examinations, by the commencement of the modified TBL session. The students were free to use material from the handout as well as any other source as reference material to help them answer the questions. The corresponding author, a faculty member, was the facilitator for the modified TBL sessions. He was responsible for the planning of the sessions, preparation and distribution of the handouts, and session evaluation. The facilitator also readied a PowerPoint presentation about each topic to make necessary clarifications to the students about any doubts that emerged during the discussion.

On the day of the session, four student groups were randomly assigned one of the four clinical case histories. The fifth group was assigned the university exam questions. The session started with the first clinical case history (numbered 1). The answer to the first question related to that case history was presented by one member of the group randomly chosen by the facilitator,

and discussed with the rest of the class. The answer to the next question was assigned to a different member of the same group to present and discuss. This process continued till the answers to all five questions related to that case history were discussed. Then the subsequent case histories were covered in a similar manner by the other groups in a sequential order (case history 2 followed by 3 and then 4). The last group had to answer the previous university examination questions. The role of the facilitator was to clear any doubts that emerged during the discussion or make necessary clarifications. The same staff member acted as the facilitator for both the sessions.

After all the eight general embryology classes were completed, the students were asked to fill up a questionnaire [Table 1]. This questionnaire was devised specifically for comparing the modified TBL sessions to the traditional lecture classes on certain key aspects of learning. The questionnaire had six items using the Likert five-point grading scale. The number and percentage of students responding to each item was noted. The mean rating for each item was calculated [Table 1]. Students' suggestions and remarks were also elicited. The facilitator's subjective opinion about the modified TBL sessions was noted.

RESULTS

Overall 54 students responded to the questionnaire. One student among these did not respond to statement number 4. Six students were absent on the day of distribution of the questionnaire. The responses to each statement are summarized in Table 1. The category with the highest number of responses for each statement has been highlighted. From Table 1, it is evident that a large majority of the students preferred the modified TBL method to the traditional lecture method of teaching. Eighty-five, 79, and 81% of the students felt that the modified TBL sessions were better at fulfilling the learning objectives, enabled better understanding of the subject and were more interesting as compared to didactic lectures respectively. Ninety-four and 98% of the students thought that the modified TBL

Table 1: The questionnaire distributed to the students with their responses to the modified team based learning classes vis-à-vis the traditional lecture classes

Sl. No.	*Statement*	*1 N (%)*	*2 N (%)*	*3 N (%)*	*4 N (%)*	*5 N (%)*	*Mean rating*	*Total no. of responses*
1.	The team based learning method was more effective in fulfilling the learning objectives	15 (28)	31 (57)	5 (9)	3 (6)	0	1.93	54
2.	The team based learning method enabled better understanding of the subject	17 (31)	26 (48)	7 (13)	3 (6)	1 (2)	1.98	54
3.	The team based learning method enabled greater student participation	32 (59)	19 (35)	2 (4)	0	1 (2)	1.5	54
4.	The team based learning method was more interesting	24 (45)	19 (36)	8 (15)	2 (4)	0	1.74	53
5.	The team based learning method required more effort on the part of the students	37 (68)	16 (30)	0	1 (2)	0	1.35	54
6.	More team based learning classes should be organized in the future	14 (26)	29 (53)	8 (15)	2 (4)	1 (2)	2.2	54

Other suggestions or remarks: N – number of responses to each statement, % - percentage of responses to each statement
Kindly give your opinions about the team based learning classes conducted by the Department of Anatomy, as compared to the traditional teaching methods 1 – Strongly agree; 2 – Agree; 3 – Neutral; 4 – Disagree; 5 – Strongly disagree

method enabled more student participation and involved greater effort on the part of students as compared to traditional teaching methods. Seventy-nine percent of students opined that more such modified TBL sessions should be organized in the future. The mean ratings for each category ranged between 1.35 and 2.2, reiterating the fact that the students appreciated this method.

Twenty of the students offered their comments or suggestions regarding these modified TBL sessions. Most of them felt that this method was good provided they were given adequate time to prepare for these sessions. However some of the students commented that this method should not be used for all classes and felt that traditional teaching methods were required for certain topics that were difficult to understand. One of the students suggested that the groups be changed for each modified TBL session to make it even more interactive. Eleven of the students responded either neutrally or negatively to the statement that more such modified TBL classes should be conducted. It was also noted that the mean rating of these eleven students for the first four items was lower than the mean class rating for the same. However, for the fifth item these students had a similar mean rating as the class as a whole. Four of the eleven students offered comments. Their concerns about this method were, the time involved in preparation, and the difficulty in grasping concepts in the limited time of the modified TBL session.

From the facilitator's point of view as well there were some positive observations. The students came well prepared for the sessions and interest in the class was kept up throughout. Most of the answers came from the students themselves and the facilitator had to use the already prepared PowerPoint presentation only to show relevant pictures and diagrams to further aid understanding. One disadvantage experienced by the facilitator was that it was more difficult to have a logical sequential flow of the material covered, as is possible in a traditional lecture, thus sometimes giving a feeling of disjointedness.

DISCUSSION

The discussion that follows focuses on the traditional lecture method vis-à-vis the modified TBL method in the context of student evaluation in the current study. The most widely used method in India for theory classes is the lecture method. It is a live personal method for motivating, sensitizing and stimulating students. Economical use is made of staff time by this method. It can also save the learner's time by providing an up-to-date summary of the topic from several sources. Difficult concepts can be clarified and emphasis can be laid on the salient features. This is also a good method for pacing the rate of working of a large body of learners.[14,16] However there are many drawbacks of this method. The passive nature of the audience and limited opportunity for feedback lead to low receptivity.[1,16] Lecturing skills of a high caliber are required to hold the attention of students for 45-60 minutes. Very often the material covered by a lecture can be more easily acquired from a textbook and has little if any clinical application. Moreover, it is imperative that something different be done within a lecture every twenty minutes or so to break the monotony.[17] Many students attend lecture classes because attendance is

mandatory or because they do not want to incur the wrath of the teacher who might be their examiner. Slow learners and under achievers learn better by tutorials, as lectures do not adapt to the rate of learning of individuals.[14,16]

In an endeavor to make the sessions allotted for lecture classes more interesting, as well as to encourage active learning and clinical problem solving by the students, the authors introduced a modified TBL approach to teaching. Four essential principles govern the successful implementation of the TBL method.[15] The first essential principle is that the groups must be properly formed and managed. Proper management includes minimizing barriers to group cohesiveness, equitable distribution of member resources, formation of fairly large and diverse teams and ensuring permanence of the groups. The second principle is that students must be made accountable. This encompasses accountability for individual pre-class preparation, for contributing to their team and for high quality team performance. The grading system also needs to be adapted to encourage the kind of student behavior that will promote learning in and from group interaction. The next principle is that the team assignments must be structured in a way so as to promote both learning as well as team development. Finally, the students must receive frequent and immediate feedback on group performance.[15]

In the Indian context it is not possible to implement a full-fledged TBL approach to teaching as this will entail a complete restructuring of the curriculum. In the present study the TBL sessions were modified so as to fit them into the time frame of a one-hour theory lecture. Thus, the principles enunciated above could be only partially fulfilled. The five groups were large and selected at random, thus ensuring that they were as diverse as possible. The same groups were retained for both modified TBL sessions thus ensuring a degree of permanence. Accountability of individual student preparation was assessed, as each student who was randomly selected from within a group, had to discuss the answer to a particular question in a case history in front of the whole class. This would have not been possible unless the student was well prepared. The team assignments were designed with a logical sequence, thus promoting learning. An additional benefit to the students was that the examination questions were also discussed. Immediate feedback was provided to each group by the faculty facilitator after discussion of the case histories. A limitation of this study was that only the subjective opinions of the students were sought and formal evaluation by the facilitator was not conducted. Thus, the effectiveness of this method in acquiring anatomical knowledge and utilizing it to perform better in examinations was not tested. Also, cohesiveness within groups was not evaluated, as in the case of a full-fledged TBL approach.

The response of the students in this study indicates that most of the students preferred the modified TBL method to the traditional lecture method. The advantages of this method are numerous. It is one of the few ways in which to achieve higher-level cognitive skills in large classes. The present generation is adept at acquiring information from a variety of sources. This method helps the students to utilize this information better and apply it on their own to

solve problems. Such problem solving abilities are required on a day-to-day basis by clinicians and the aim of this method is to produce better quality physicians. As active participation of the students is required, this ensures that the students remain alert during the entire session. Communication skills, so essential for physicians, are developed by this method. In addition, students learn better when they have to explain their thought process, rather than just reading a book and attending a lecture and assuming that they have understood the topic. Examination questions can also be included in these sessions thus assuaging the apprehension that students will be unprepared to answer examinations. A great benefit of TBL method is that it has a tremendous positive impact on the instructor. With this method, the boredom brought about by needing to repeatedly explain basic concepts and simple facts is relieved. The questions that are thrown up in discussion are likely to be challenging enough to be interesting. In addition, students are more likely to attend classes if they are made interesting and problems of attendance shortage will reduce.[14,15]

Some of the drawbacks of this method were indicated by the comments in the feedback provided by the students. The students felt that adequate time should be given to prepare for the classes. Thus, it is not possible to use this method successfully if the classes follow each other in close succession, as is often the case in most medical colleges. Some of the students felt that difficult concepts within a particular topic needed a lecture class and that these topics could not be adequately covered by the modified TBL method. A solution to this could be to have short lecture classes emphasizing important concepts along with active learning methods.[17,18]

Nieder *et al.* have used the TBL method for teaching gross anatomy and embryology at the Wright State University School of Medicine, Dayton, Ohio. Their first experience with this method was positive. The faculty felt that this method ensured a closer interaction between them and the students. The students felt that working in teams was an effective way of learning content and applying this to practice clinical reasoning skills. Although there was no significant difference in the class grade average, the grade distribution was not spread as much. In particular the low-end tail of the curve was smaller, yielding fewer failures. The authors feel that there is scope for wider application of this method in medical education.[12] Other studies have shown that knowledge acquisition with the TBL method compared favorably with more traditional methods such as lectures.[13,19-22] Parmelee *et al.* have recently assessed the attitudes of medical students to TBL in the pre-clinical curriculum. The students had to answer a questionnaire which assessed overall satisfaction with team experience, impact on quality of learning, satisfaction with peer evaluation, team impact on clinical reasoning ability and professional development. Overall, the students gave a favorable evaluation of the TBL method of teaching. The authors feel that TBL could have a role in medical colleges, especially as a method to explore the non-cognitive domains of learning.[1]

There is a growing body of evidence from a number of different disciplines to support the efficacy of active learning.[7,23] It is

therefore imperative for teachers to create an appropriate learning environment where these active learning methods can be effectively implemented. The teachers can devote their time and energy to develop problem situations for group tasks. The information of today may become outdated in five years but if the student has learnt how to gather data, analyze it and solve problems, he would be able to tackle any new problem situation with confidence. The authors hope that this innovative teaching method will help students to become better and scientific physicians rather than just pass examinations.

CONCLUSION

The authors have described a relatively new approach for teaching embryology to medical undergraduates, called the modified TBL method. The students' response was encouraging and a majority of them preferred the modified TBL method to the traditional lecture method and wanted these sessions to be continued in the future. From feedback provided by the students, the authors suggest that topics with a predominantly theoretical basis and not much clinical applicability could be taught using the traditional lecture method. A modified TBL method could be used for other topics with more clinical relevance.

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