A study to compare the effectiveness of Case Based MCQ led Tutorials (CBML) Vs Traditional Tutorials (TT) among second year undergraduate medical students

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How to citation this article: Elango Karthik, Patel Prakruti, Gandhi Anuradha, Desai Chetna,"A study to compare the effectiveness of Case Based MCQ led Tutorials (CBML) Vs Traditional Tutorials (TT) among second year undergraduate medical students", IJMACR- July – August - 2022, Vol – 5, Issue - 4, P. No. 154 – 162.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: To facilitate the student centric CBME, a hybrid model for teaching as well as assessment was developed using CBML tutorials as a small group teaching method.

Methodology: The study was conducted after obtaining permission from the Institutional Ethics Committee and the Head of Department, Pharmacology. After an interactive lecture on tuberculosis, the 2nd year students were divided into, A&B batches. Each batch was subdivided into 5 sub batches. Batch A was taught by TT method and Batch B by CBML method. A pre-test and post-test containing 10 knowledge-based MCQs was used for evaluation. A cross over was done on the topic of malaria. Feedback was obtained about CBML from the students.

Results: In 55 students (47.83%) in CBML group and 60(52.17%) in TT group for the topic of Malaria, the mean post-test scores (CBML=7.98±1.37; TT=7.4±1.77) showed significant increase as compared to their respective mean pre-test scores (CBML=6.73±1.64; TT=6.7±2.08: $p<0.05$). Similarly, in 70 students (51.09%) in CBML group and 67(48.91%) in TT group for Tuberculosis, the mean post-test scores (CBML=8.46±1.37; TT=8.27±1.71) showed significant increase as compared to their respective mean pre-test scores (CBML=7±2.38; TT=7.03±2.12: $p<0.05$). The mean post-test scores were higher in CBML group as compared to TT group, but not statistically significant (Malaria: CBML=7.98±1.37; TT=7.4±1.77) (Tuberculosis: CBML=8.46±1.37; TT=8.27±1.71). Feedback analysis emphasized that students strongly favoured CBML on Likert scale.

Conclusion: CBML, a new teaching learning method helps to increase knowledge as well as stimulate interest in students.

Keywords: CBME (Competency Based Medical Education), CBML (Case Based MCQ led Tutorials), MCQs (Multiple Choice Questions), TT (Traditional Tutorials)

Introduction

As per the new NMC curriculum, small group teaching methods are the need of the day [1]. The current CBME is student centric in its approach where the teacher serves the role as a facilitator. The focus on applied pharmacology enriches the critical thinking of students and helps them to apply their knowledge into practice [2]. Case-based scenarios help them in rational therapeutics, where MCQs are used as assessment tool [3]. Active learning happens when students are given the opportunity to develop a more interactive relationship with the subject matter of a course, encouraging them to generate rather than simply receive knowledge. In an active learning environment, teacher facilitates students' learning. Adoption of active learning strategies strengthens students learning as they apply their own experiences and previous knowledge [4].

Numerous teaching- learning methods are practiced throughout the MBBS course, to increase involvement, participation and interest of students, so that learning is facilitated and it appeals to students with different learning styles. The challenges of medical education in India are similar to other developing nations. The new CBME is more patient centric and a holistic approach is being employed.

Small group teaching learning methods include Group discussion, small group discussion and other types of group discussion which include Controlled discussion, Free Group Discussion, Buzz- Group, Brain Storming, Syndicate, Therapeutic Group and other methods include Seminar, Tutorial, Demonstration, Practicals/ bedside teaching/ field work, Role Play, Workshop and Individual methods like Reading, Programmed learning, Project, Conference, Counseling, Simulation, Worksheets/ surveys, Report- back sessions, Case studies, Videotapes [5,6]. The advantages of tutorials are that limited numbers of students are taught in a group on a particular subject by tutor to clear doubts, which improve their understanding and enhance knowledge of a subject, help to discover and correct mistakes, help to find out the extent of learning and there is an ideal teacher student ratio. Case studies develop analytic and problem-solving skills and allow for exploration of solutions for complex issues, and allows student to apply new knowledge and skills [7]. Such case studies take the student to a higher level of thinking and the student is taken to a level of application as per Miller's pyramid.

Mastering the art and acquiring the knowledge of prescribing drugs is an essential skill required by all Indian Medical Graduates and are considered to be mandatory certifiable skills. Drugs prescribed to the patient should be appropriate to the case encountered and must have a justification. This justification should be based on the principles of both evidence- based approach and recently approved guidelines. Medical students in their early years get confused with integrating the knowledge of basic pharmacology and clinical practice. MCQ- based teaching, which involves case- based learning (CBL) as a teaching tool for basic medical sciences has been greatly valued [8,9]. It has shown to improve students' understanding of the subject, which has resulted in improved performance in assessments and practice. MCQ- based teaching with CBL in clinical pharmacology can bridge the gap between theory and practice [10]. Hence, the study aimed to evaluate the effectiveness of Case based MCQ led

tutorials versus Traditional tutorials among second year undergraduate medical students. The study also aimed to develop and gather perception of students regarding CBML.

Materials and Methods

Study Tools

1) Pre-test and Post-test MCQs: A prevalidated 10 MCQs were used to test the baseline knowledge of the students regarding the topic of discussion as pretest. For the post test the same 10 MCQs were used to see their increase in knowledge about the topic.

2) Case based MCQs: In the CBML group, all the questions would be of case- based learning, discussing solutions for all case- based scenarios of the said topic. The MCQs were framed in such a way that it covers all essential aspects of the topic, including all common case- based scenarios, special scenarios like children, pregnant and lactating women, geriatric population and association with other co-morbidities. These included clinical application aspects of the topic.

3) Feedback: A questionnaire based feedback about the new method ie CBML was obtained from the students on Likert scale about the relevance of the topic, effectiveness to stimulated interest, assistance in understanding the content, providing guidance on how to learn effectively, more learning than traditional tutorial, looking forward to have more of this kind of CBML tutorial, opportunity to clear the doubts, knowledge gained would help me in my practice, increase in attention span and increased student participation

Study Procedure

The study was a prospective, comparative study conducted in second year MBBS students at Department of Pharmacology, B.J. Medical College, Ahmedabad, over a period of 4 weeks. The study was conducted after

obtaining permission from the Institutional Ethics Committee and the Head of Department, Pharmacology. Two clinically important tutorial topics viz., Tuberculosis and Malaria were selected and seven Case based MCQ questions for each topic were framed and validated by faculties of the department.

Before the tutorial was conducted for the students, a brief interactive lecture of the same topic was taken for the students by power point presentation method which included classification and details of drugs. After 2 weeks, the tutorial of the same clinically important topic i.e., Tuberculosis was conducted by traditional method of discussion (TT) for one batch and the new innovative method of MCQ- based teaching for the other batch (CBML). Both A (TT) and B (CBML) batch were divided in 5 small subgroups of students. A pre-test comprising 10 knowledge-based MCQs was provided to the students before the start of the tutorial for a test duration of 10 minutes, to test the baseline knowledge of students for both the batches. After the tutorial session, which lasted for a duration of one hour, a post- test is conducted for both batches, which contains 10 knowledge-based MCQs for a duration of 10 minutes.

On week 2, post-test questions were discussed for both batches to strengthen their understanding of the topic and a feedback of teaching- learning method adopted was obtained from the students and faculties. All the queries pertaining to the topic were cleared during this session.

On week 3, a crossover was made and students, A batch was taught by CBML and B batch by TT another clinically important topic viz., Malaria. The same procedure was repeated. Finally, the results were assessed and analyzed and their feedbacks evaluated

using independent sample t test, paired t test and Chi square test.

Results

This was a prospective, comparative study conducted over a period of four weeks. A total of 115 students participated in Malaria tutorials and they were divided into two batches, Batch A and Batch B. Batch A was the TT group, which comprised 60 students (52.17% of 115) and Batch B was the CBML group, which comprised 55 students (47.83% of 115). A total of 137 students participated in Tuberculosis tutorials and they were divided into two batches, Batch A and Batch B. Batch A was the CBML group, which comprised 70 students (51.09% of 137) and Batch B was the TT group, which comprised 67 students (48.91% of 115). The mean age of the study population in Batch A (TT Malaria) was 19.64±0.65 (Mean±SD) years, Batch B (CBML Malaria) was 19.65±0.68 (Mean±SD) years, Batch B (TT Tuberculosis) was 19.58±0.63 (Mean±SD) years and Batch A (CBML Tuberculosis) was 20.23±0.69 (Mean±SD) years.

Out of 60 students in TT malaria, 45 (75%) were male and 15 (25%) were female with a male-to-female ratio of 3:1; out of 55 students in CBML malaria, 39 (70.91%) were male and 16 (29.09%) were female with a male-to-female ratio of 2.44:1. Out of 70 students in CBML tuberculosis, 55 (78.57%) were male and 15 (21.43%) were female with a male-to-female ratio of 3.67:1; and out of 67 students in TT tuberculosis, 51 (76.12%) were male and 16 (23.88%) were female with a male-to-female ratio of 3.19:1.

Test scores

As seen in table 1 in the CBML Tuberculosis (n=70), the mean post-test scores (8.46± 1.37) of students showed statistically significant improvement as compared to their respective mean pre-test scores (7± 2.38) (p<0.001). For TT Tuberculosis (n=67), the mean post-test scores (8.27± 1.71) of students showed statistically significant improvement as compared to their respective mean pre-test scores (7.03± 2.12) (p<0.001). For TT Malaria (n=60), the mean post-test scores (7.4± 1.77) of students showed statistically significant improvement as compared to their respective mean pre-test scores (6.7± 2.08) (p<0.001). For CBML Malaria (n=55), the mean post-test scores (7.98± 1.37) of students showed statistically significant improvement as compared to their respective mean pre-test scores (6.73± 1.64) (p<0.001).

Table 1: Pre-test and post-test scores of TT and CBML groups

Groups	Pre-test scores (Mean±SD)	Post-test scores (Mean±SD)	Paired t test significance (p value)
TT Malaria	6.7±2.08	7.4±1.77	<0.001
CBML Malaria	6.73±1.64	7.98±1.37	<0.001
TT Tuberculosis	7.03±2.12	8.27±1.71	<0.001
CBML Tuberculosis	7±2.38	8.46±1.37	<0.001

For Tuberculosis, the mean post-test scores of CBML group (8.46± 1.37) were higher compared to the mean post-test scores of TT group (8.27± 1.71), but not statistically significant by using independent sample t test (p>0.05). Similarly for Malaria, the mean post-test scores of CBML group (7.98± 1.37) were higher compared to the mean post-test scores of TT group (7.4± 1.77), but not statistically significant by using independent sample t test (p>0.05).

Table 2: Improvement in scores in in TT and CBML groups

Topic	TT Mean improvement in scores (Mean±SD)	CBML Mean improvement in scores (Mean±SD)	Independent sample t test significance (p value)
Tuberculosis	1.24±1.53	1.46±1.96	0.23
Malaria	0.7±1.38	1.25±1.77	0.03

The improvement in scores was calculated by the difference between pre-test and post-test scores. For the topic of Tuberculosis, the mean improvement in scores of CBML (1.46±1.96) were higher as compared to the mean improvement in scores of TT (1.24±1.53), but this difference was not found to be statistically significant (p=0.23). For the topic of Malaria, the mean improvement in scores of CBML (1.25±1.77) were higher as compared to the mean improvement in scores of TT (0.7±1.38) and this difference was found to be statistically significant by using independent sample t test (p=0.03).

Even an increase of one score in post-test scores compared to their respective pre-test scores is considered as improvement, while no change in post-test scores or decrease in post-test scores compared to their respective pre-test scores is considered as no improvement. In TT Tuberculosis group, out of 67 students, 45 students (67.16% of 67) showed improvement of atleast one score in post-test scores Similarly, in CBML Tuberculosis group, out of 70 students, 47 students (67.14% of 70) showed improvement of atleast one score in post-test scores.When these two groups were compared using chi square test, the difference in the number of students who improved in post-test scores was not found to be statistically significant (p>0.05).

In TT Malaria group, out of 60 students, 31 students (51.67% of 60) showed improvement of atleast one

score in the post-test scores. Similarly, in CBML Malaria group, out of 55 students, 34 students (61.82% of 55) showed improvement of atleast one score in post-test. As seen in table 3 when these groups were compared using chi square test, the difference in the number of students who improved in post-test scores was not found to be statistically significant (p>0.05).

Table 3: Comparison of students who improved and did not improve in four different groups

Groups	No. of students with improvement in post-test scores	No. of students without improvement in post-test scores	Chi square test statistic (p value)
TT Malaria	31 (51.67%)	29 (48.33%)	χ^2 = 2.4616 (p= 0.12)
CBML Malaria	34 (61.82%)	21 (38.18%)	
TT Tuberculosis	45 (67.16%)	22 (32.84%)	$\chi^2 = 0$ (p= 1)
CBML Tuberculosis	47 (67.14%)	23 (32.86%)	

Feedback Evaluation

Feedback was collected from the study participants as well as faculties. When the feedback of students regarding CBML tutorials were analysed on the mean Likert's scale score whose total score was 5majority of the parameters showed the score to be more than 4.5 (table 4). When the feedbacks from students were analyzed, it was found that 83.2% of students strongly agreed that the CBML tutorial was relevant to the topic, 74.4% of students strongly agreed that the CBML tutorial stimulated interest in the topic, 67.2% of students strongly agreed that the CBML tutorial assisted them in understanding the content of the lecture, 63.2% of students strongly agreed that the CBML tutorial provided guidance on how to learn effectively for the topic, 70.4% of students strongly agreed that they would

have learnt more than they would have by participating in a traditional tutorial, 75.2% of students strongly agreed that they look forward to more of CBML tutorial, 66.4% of students strongly agreed that the opportunity to clear the doubts was given, 75.2% of students strongly agreed that knowledge gained through this CBML tutorial would help them in their practice, 67.2% of students strongly agreed that the attention span was increased with this CBML tutorial and 69.6% of students strongly agreed that the student participation was more.

Table 4: Feedback Analysis about CBML from participants (n=125)

S.No.	Feedback Questions	Likert's scale scores (Out of 5) (Mean±SD)
1.	The CBML tutorial was relevant to the topic	4.82±0.43
2.	The CBML tutorial stimulated interest in the topic	4.71±0.52
3.	The CBML tutorial assisted me in understanding the content of the lecture	4.63±0.56
4.	The CBML tutorial provided guidance on how to learn effectively for the topic	4.58±0.6
5.	I learned more than I would have by participating in a traditional tutorial	4.6±0.75
6.	I look forward to have more of this kind of CBML tutorial	4.67±0.62
7.	Opportunity to clear the doubts was given	4.62±0.58
8.	Knowledge gained in this CBML tutorial will help me in my practice	4.68±0.62
9.	Attention span is increased with this CBML tutorial	4.62±0.6
10.	Student participation is more	4.63±0.6

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

Feedback Analysis about CBML from faculties (n=10)

All the faculties (100%) agreed that the CBML has helped the students to understand more effectively than TT and case based MCQ led tutorials is appropriate to enrich critical thinking of students in comparison to traditional tutorials. Ninety percent of the faculties (9 out of 10) agreed that the CBML should be included as a teaching learning method. The strengths of CBML were found to be that it provided insight about real life scenarios (50%), better understanding of the topic (40%), interactive and engaging (30%), comprehensive and specific (20%) and highlighted important aspects (20%). The drawbacks of CBML were found to be that it required in-depth preparation and understanding by faculties (50%), only specific sub-topics could be covered (30%), limited knowledge of students posed difficulty in interpretation (20%), flow of teaching could not be maintained (20%) and time consuming for preparation and discussion by faculties (20%).

Discussion

A small group teaching session that is well planned provides a systematic approach for both teachers and learners. Compared to didactic lectures, effective small group teaching and learning strategies increase student engagement, retention of knowledge, self-directed learning, communication skills, teamwork ability, and peer discussion. Small group teaching helps the students to learn better by reinforcing their knowledge and skills learnt [11].

Multiple small group methods have been tried and have been found to be effective for teaching. As per the present scenario MCQs are used for as an assessment tool for entrance examination for selection of postgraduate course. During their undergraduate

teaching students use MCQs for passive learning. Case based MCQs provide the students with real life scenarios and to help them navigate those problems with critical thinking by creating interest and curiosity in them.

But if the students are engaged in active learning using Case based MCQs it will put them into an active learning situation where the students have a better understanding, increase retention and increase motivation to learn. MCQs are used as an assessment tool. But in this study MCQs have been used as a teaching tool using Case Based MCQ led Tutorials (CBML). Topics like Tuberculosis and Malaria were selected to familiarize the students with the commonly encountered clinical conditions in our country and to strengthen their knowledge and understanding with clinical application of these conditions.

The CBML tutorials were introduced to integrate case-based scenarios in multiple choice questions to teach students in small group teaching in tutorials. The study was conducted among second year undergraduate medical students in the Department of Pharmacology to evaluate the effectiveness of CBML tutorials and to develop and gather perception of students regarding the same. In our study, we had 4 different groups, TT Malaria, CBML Malaria, TT Tuberculosis and CBML Tuberculosis. In our study, for TT Malaria, CBML Malaria, TT Tuberculosis, and CBML Tuberculosis, the mean post-test scores showed significant improvement compared to their respective mean pre-test scores. For the topic of Malaria, the mean improvement in scores in CBML group showed significant difference compared to the mean improvement in scores in TT group.

In our study, for Malaria, the mean post-test scores of CBML group (7.98± 1.37) were higher compared to the mean post-test scores of TT group (7.4± 1.77), but not significant and for Tuberculosis, the mean post-test scores of CBML group (8.46± 1.37) were higher compared to the mean post-test scores of TT group (8.27± 1.71), but not significant. Similar to our study, a study conducted by Kamat SK et al[12] showed that, when the average marks obtained by both groups for the post-test were compared, there was no significant difference between the average marks obtained by the Case based teaching group (32.69 ± 6.75) and Traditional method of teaching group (30.07 ± 6.82).However, in our study we had used cased based MCQs as a teaching tool while in the study by Kamat SK et al the teaching tool was case based senerios[12]. As per our study, the students strongly agreed that the CBML tutorial was relevant to the topic (83.2%), assisted in understanding the content of lecture (67.2%). Similar results were obtained in the study by Tayem YI [13], where the students said that the cases were appropriate to the lecture topics (96%) and that Case based learning was an effective learning tool for them (82%).

When the feedbacks were analysed, it was found that both students and faculties strongly favoured CBML tutorials over TT tutorials. Our study results disclose that students strongly agreed that they would have learnt more than they would have by participating in a traditional tutorial (70.4%). Similar results were observed in the study conducted by Gupta K et al[14], where majority of the students (76.09%) found the Cased based learning sessions to be better than theory lectures and tutorials. According to our study, the mean post-test scores of CBML groups of Malaria and Tuberculosis was not significant compared to their respective mean post-test scores of TT groups. Whereas, the study conducted by Vora MB and Shah CJ [15], case-

based learning group showed significantly increased (P<0.001) test score in clinical application compared to lecture group.

Our study is different from other studies as most of the studies compared case-based teaching with didactic lectures and evaluated the scores in both groups and drew conclusions. Or the studies involved problem-based questions in large groups and assessed using the feedbacks. The present study evaluated case-based MCQ led tutorials as a small group teaching method and used MCQs as a base to teach application of the drugs that are used in real practice specially scenarios like pregnancy children, complication and ADRs faced during treatment. We also evaluated both the post test scores and the feedbacks of the students, which has not been conducted in previous studies. So, it has the advantage of integrating small group teaching and case-based learning through multiple choice questions and evaluating the effectiveness in comparison to traditional tutorials. Furthermore, feedback from faculties was also taken into consideration to amalgamate their inputs and furnish a better design for further studies and implementing in the academic curriculum.

Conclusion

CBML, a new teaching learning method helps to increase knowledge as well as stimulate interest in students. Undergraduate medical students and faculties favour CBML over TT through feedback responses. Even if CBML tutorials is not solely introduced as a teaching-learning method, we could consider implementing this strategy as a supplementation tool along with TT, to strengthen the understanding of the students through clinical application.

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