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“Comparison of Case-Based Learning and Conventional Method in Pharmacology Among Undergraduate Medical Students in a Large Group Setting”

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Abstract

1. Background:

The subject of pharmacology is very wide, challenging, and swiftly growing in nature due to fast-paced drug discoveries and clinical trials. The introduction of a case-based, integrated learner-centered medical course demands active involvement from students, stimulates them and facilitates self-directed learning. The Medical Council of India has also suggested the introduction of Case-Based Learning (CBL) in medical education.

Purpose: To evaluate the effectiveness and acceptance of CBL among the students of 2nd M.B.B.S. (Bachelor of Medicine & Bachelor of Surgery).

2. Methods:

It was an educational interventional study conducted online using google classroom. Two hundred students of the 2nd M.B.B.S. batch were enrolled for the study, divided into four equal groups: Group A, Group B, Group C, and Group D. For each group and each method, four unique links were made. Two topics were selected for teaching through both methods. Their upcoming syllabus and the core area were used to decide topics.

3. Results:

There was a significant improvement in performance scores with the CBL method in all four groups when compared with the conventional method using the “paired t-test”. The majority of the students agreed positively with various aspects of CBL.

4. Conclusions:

The CBL as a TL (Teaching - Learning) tool in pharmacology is a learner-centered teaching approach. The results of the study showed effectiveness in the form of improvement in performance scores and most of the students agreed positively (followed by strongly agree) with various aspects of CBL. So, it was concluded that CBL can be used with conventional methods to strengthen the topic and will play a major role in CBME (Competency-Based Medical Education), especially in pharmacology.

Keywords: Case-based learning, IDA, CHF, Teaching learning tool

Running title: Comparison of Case-Based Learning and Conventional Method in a large group setting

Introduction:

The subject of pharmacology is very wide, challenging, and swiftly growing in nature due to fast-paced drug discoveries and clinical trials.¹ The ability to prescribe drugs that are essential should be learned by junior doctors. Patients should be prescribed appropriate medicines according to their conditions and their use must have been justified based on the concept of both evidence-based approach and recently approved guidelines. Basic pharmacology knowledge and its clinical application are often difficult for medical students to integrate.² There is a switch from standard didactic lectures to small group tutoring to make teaching more learner-centered. Additionally, many innovative approaches like Case-Based Learning (CBL), Problem-Based Learning (PBL), and Team-Based Learning (TBL) are adopted in undergraduate medical education to promote dynamic and productive bilateral learning.³

The introduction of a case-based, integrated learner-centered medical course demands active involvement from students, stimulates them and facilitates self-directed learning. The introduction of Case-Based Learning (CBL) in medical education has also been suggested by the National Medical Commission.⁴ Case-Based Learning (CBL) is a new innovative process of imparting basic medical science.² Through the integration of clinical aspects and conditions, undergraduate learning is based on real-world circumstances.⁵ This approach helps students to understand the subject and its application on the clinical side. The gap between theory and clinical practice can be bridged by CBL in pharmacology.²

The objectives of the present study were to introduce and study the effectiveness of CBL as a Teaching – Learning (TL) tool and to check the acceptance of CBL among 2nd year M.B.B.S. students in the subject of pharmacology.

Materials and Methods:

Study design and Study sample:

It was an educational interventional study conducted online which was the only option during covid-19, using google classroom after receiving approval from Human Research Ethics Committee (HREC). After demonstrating their willingness in accordance with the inclusion criteria, two hundred students from the 2nd MBBS batch were included in the study.

Inclusion criteria:

1. All students from 2nd MBBS batch who have given consent to participate.

Exclusion criteria

1. Absent students & students not willing to give consent.
2. Students who have been previously exposed to CBL methodology.

Students were divided into four groups, and the method each group would get was determined by lottery method then cross-over was done for the next method. For each group and each method, four unique links were made.

For each group, a faculty member was allotted as a facilitator. Two topics were selected for teaching through both methods. Their upcoming syllabus and the core area were used to decide topics. The topics were Iron Deficiency Anaemia (IDA) and Congestive Heart Failure (CHF). The following table provides group-wise topic distribution using TL method and cross-over. (Table 1).

Table 1: Group-wise topic distribution with the TL method and cross-over

IDA				CHF			
Group A (Conventional)	Group B (Conventional)	Group C (CBL)	Group D (CBL)	Group A (CBL)	Group B (CBL)	Group C (Conventional)	Group D (Conventional)

(Abbreviations: IDA- Iron Deficiency Anemia, CHF- Congestive Heart Failure, CBL- Case-Based Learning)

The Conventional method involved an hour-long didactic lecture using power point slides.

For CBL method students and faculty members (facilitators) were initially sensitized to CBL. Then, two CBL sessions were conducted (one hour each). The group discussion of clinical case scenarios, such as clinical symptoms, relevant investigations, diagnosis, and management, was enabled during the first session. Before attending the second sitting of the same module, the facilitators gave the group a summary of the key points and learning objectives of the clinical case at the conclusion of the first sitting. They also gave instructions regarding reference resources and learning materials in order to encourage self-study habits.

The same module was introduced by the facilitator at the second sitting, and the group was given an hour to discuss the management of co-morbid conditions, complications, and drug-related updates.

Immediately following the completion of the topic, twenty (20) multiple-choice questions (MCQs) were administered for the assessment test using both methods for a total of 30 minutes, and feedback regarding both teaching methods was collected using a 15-minute Five Point Likert Scale feedback questionnaire after assessment test. Experts from our institute prepared and peer reviewed cases, exam items, and MCQ questionnaires.

Results:

Multiple choice questions (MCQs) were given to all the groups for 30 minutes, immediately after completion of the topic each time. Table 2 shows that in case of iron deficiency anaemia, 60 percent of students in Group C and 58 percent of students in Group D obtained marks above 15 using the CBL method. 26 percent of students in Group A and 52 percent of students in Group B obtained marks above 15 using the conventional method. With the help of the CBL method, no one in Group C had a marks below 7, whereas in Group D, 6% of students received marks below 7. By using the conventional method, 10% and 4% of students in Groups A and B, respectively, obtained marks below 7.

In cases with congestive heart failure using the CBL approach, 30% of students in Group A and 90% of students in Group B obtained marks of 15 or higher. By using the conventional method, 62% of Group C students and 58% of Group D students received marks above 15. By CBL or the conventional method, no one obtained marks below 7. Thus, it demonstrates that using CBL over the conventional method resulted in higher performance results.

Table 2: Assessment Scores

MCQ scores	IDA				CHF			
	Group A (Conventional)	Group B (Conventional)	Group C (CBL)	Group D (CBL)	Group A (CBL)	Group B (CBL)	Group C (Conventional)	Group D (Conventional)
15-20	13 (26%)	26 (52%)	30(60%)	29(58%)	15(30%)	45(90%)	31(62%)	29(58%)
8-14	32(64%)	22(44%)	20(40%)	18(36%)	5(10%)	5(10%)	19(38%)	21(42%)
0-7	5 (10%)	2 (4%)	0	3 (6%)	0	0	0	0

(Abbreviations: IDA- Iron Deficiency Anemia, CHF- Congestive Heart Failure, CBL- Case-Based Learning)

Performance scores in all four groups improved with CBL.

In Table 3, the paired t-test was used to statistically analyse the performance scores of the students. When comparing the CBL approach to the conventional method, there was a significant (P value 0.000283) improvement in the performance score for a case of iron deficiency anaemia. Likewise, the CBL approach significantly (0.000001) outperformed the conventional method in terms of performance score in case of congestive heart failure.

Table 3: Group-wise P value

	IDA				CHF			
	Group A (Conven- -tional)	Group B (Conven- -tional)	Group C (CBL)	Group D (CBL)	Group A (CBL)	Group B (CBL)	Group C (Conven- -tional)	Group D (Conven- -tional)
P value	0.000283				<0.000001			
Mean per study type	12.9 (Conventional)		14.8 (CBL)		18.2 (CBL)		11.7 (Conventional)	
Mean	12.8	13.8	15.6	14.0	11.6	11.6	11.9	11.6

(Abbreviations: IDA- Iron Deficiency Anemia, CHF- Congestive Heart Failure, CBL- Case-Based Learning)

Table 3 demonstrated a statistically significant increase in the CBL group's score for each of the two topics.

Following the conclusion of both sessions, 15 minutes of feedback using Five Point Likert Scale feedback questionnaire was collected about both teaching techniques. Feedback form with a Five Point Likert Scale is listed in Table 4. 21.5 percent of students strongly agreed and 52.9 percent of students agreed that CBL can help students enhance their communication abilities. 22.4 percent of students strongly agreed that CBL can improve analytical and problem-solving skills of the students. Learning through CBL is more engaging than didactic lecture, strongly agreed by 26% of students, followed by agreement by 47.5% of students. 28.7% of students gave CBL their strong recommendation for forthcoming M.B.B.S. batches. However, CBL for upcoming M.B.B.S. batches was strongly opposed by 8.1% of students. Most students strongly concur with various CBL components, according to Table No. 4.

Table 4: Study participants' feedback on CBL

(Five Point Likert Scale feedback questionnaire)

Five Point Likert Scale feedback questionnaire	Responses (%)				
	Strongly agree	Agree	No opinion	Disagree	Strongly disagree
Proper introduction was given to clinical case-based teaching and expected benefits	18.8	52.5%	20.2%	10.3%	4%
CBL provides more time to understand the concepts by self	18.4	59.2%	16.6%	5.8%	4%
CBL in groups improves communication skills	21.5	52.9%	16.1	7.2	5.4
Role of facilitator is required	23.3	53.8	18.8	3.6	4
CBL creates interest to participate in group discussion	19.3	56.1	17.9	3.6	4
CBL is more interesting than didactic	26	47.5	22.9	7.2	3.1

lectures					
CBL provides opportunity to discuss more comfortably with facilitator	16.1	50.7	26.5	5.4	4.5
CBL method of learning is beneficial at clinical settings	26	52.5	13.5	5.4	4.5
Analytical and problem-solving skills were improved by CBL	22.4	54.7	18.4	3.6	4
Learning is more interesting and joyful by CBL	21.1	51.6	22	5.8	4.5
Recommend CBL for forthcoming M.B.B.S. batches	28.7	45.7	17.5	7.2	8.1

(Abbreviations: CBL- Case-Based Learning)

Discussion:

In the educational system traditional teaching methods have been replaced with student-directed learning and active student participation. A prototype for education that integrates various academic fields is CBL. It provides the student with a chance to efficiently comprehend knowledge. With a focus on lifelong learning, CBL encourages analytical thinking. CBL is a technique of instruction that puts the focus on the students and establishes self-directed learning environments so they can learn more and develop their performance and analytical abilities.⁶

The objectives of the present study were to introduce CBL, examine its efficacy as a teaching-learning (TL) tool, and determine whether pharmacology students in their second year of M.B.B.S. would accept it.

In this study, in case of iron deficiency anaemia using conventional approach in Group A, 26% of the students obtained marks above 15, 64% received marks in the range of 8 to 14, and 10% received marks below 7. In Group B, 52% of students obtained marks between 15 and 20, 44% received grades between 8 and 14, while 4% of students received marks below 7. According to the CBL approach, in group C, 60% of students received marks above 15, 40% received marks in the range of 8 to 14, and no student had a grade lower than 7. In group D, 6 percent of students received marks below 7, compared to 36% of students who obtained marks between 8 and 14 and 58% of students who received marks above 15.

In case of chronic heart failure using the conventional method in Group C 62% students got marks above 15, and 38% students received marks in the range of 8 to 14. No student had a grade below 7. In Group D 58% of students received marks above 15, 42% received marks between 8 to 14 and no one has below 7 marks. By CBL method in Group A above 15 marks

were received by 30% and 10% students received marks between 8 to 14. Not a single student received below 7 marks. In Group B 9% of students received marks above 15, 10% students obtained marks in the range of 8 to 14 and no one had below 7 marks. These findings demonstrate an improvement in the performance scores in the CBL-taught groups. Similarly, study done by Dave U. et al. revealed a significantly higher post-test score for the CBL group as compared to the group that received didactic lectures.⁷ In the study by Alaagib NA et al. comparison of the two methods' effectiveness revealed that students performed noticeably better on quizzes from LBP (lectures based on issues) than from TL.⁸ In a research by Diwan JS et al., post-test results in the CBL group were significantly higher than those with the tutorials.⁹ In a study conducted by Somu L., the CBL group significantly outperformed the didactic lecture group on the post-test.¹⁰

In the current study, 18.8% strongly agreed and 52.5% agreed that clinical case-based education and its anticipated benefits were properly introduced. However, 10.3% of students showed disagreement with this. 18.4% of respondents strongly agreed and 59.2% agreed that CBL provides more time to understand the concepts. Among the total participants, majority of participants (52.9%) showed agreement and 21.5 % strongly agreed that CBL enhances communication abilities in groups. While 23.3 percent of students firmly believed that the facilitator role was necessary. 19.3 percent of the overall students strongly agreed, and 56.1 percent agreed, that CBL stimulates interest in group discussion. 26% of students firmly agreed that CBL was more engaging than didactic lectures. 50.7 percent of students and 16.1% strongly agreed that CBL offers the chance to talk more comfortably with the facilitator. However, 26.5% of students were silent on this subject. 26 % of students strongly believed that CBL method of learning was beneficial at clinical settings. 22.4% students strongly agreed and 57.4% agreed that CBL increased their ability to think critically and solve problems. 21.1% students strongly agreed, and 51.6% students agreed that CBL made learning more engaging and joyful. 28.7% of students strongly advise future M.B.B.S. batches to attend CBL. However, 8% of students strongly opposed this. According to the feedback survey findings mentioned above, most students approved of various CBL aspects. According to Tayem YI. small group case-based learning dramatically increased students' capacity for independent learning, skills of critical thinking and communication. Additionally, he observed that CBL improved students' attendance, participation in lectures and teamwork.¹¹

CBT (Case-Based Teaching) was shown to facilitate the learning of rational pharmacotherapy by Kamat S. et al. It improved the ability of students to solve problems logically and their rational prescribing skills.¹² Ciraj AM et al. also reported that CBL boosted students' learning, analytical skills and their decision - making abilities. They also pointed out that that cases used during CBL shifted the focus of students learning beyond the obvious and encouraged students to utilize scientific knowledge to frame questions and respond them.¹³

Dubey S. et al. concluded that introduction of cases generates interest, encourages active learning, and helps in the development of critical thinking and analysis in undergraduate medical students. Particularly in the early stages of undergraduate medical education, which deal with pre- and para-clinical specialties, they recommended including CBL together with lectures on clinically essential cases.¹⁴ In general, CBL is more engaging, and students are better able to grasp the relationship between knowledge and clinical practice, according to Hansen WF et al.¹⁵ According to students who participated in the study by Dave U. et al., the CBL approach was engaging, promoted active learning, boosted cognitive ability, and provided a rewarding experience.⁷

Vora M. et al. self-learning approach, better understanding of basic concepts, critical thinking with integration of subject and arousal of interest in the subject were the favorable results of the introduction of CBL in the teaching of pharmacological principle.¹⁶ The findings of our earlier study (Patel CR. et al.) demonstrated effectiveness in the form of improvement in performance score and majority of the students agreed favorably with various aspects of CBL compared to conventional method. It was concluded that CBL can be used with conventional methods to enrich the topic and would be a key component of CBME especially in pharmacology.¹⁷

CBL technique needs time, knowledge, and attention. CBL method adoption should not be discouraged for this reason, since it is crucial for active student learning.¹⁸ It has been recommended that 'Hybrid CBL' where case based learning is integrated with didactic lectures, tutorials can be adopted by institutions with limited resources.¹⁹

Numerous new intervention should be integrated into teaching-learning process, as it helps teachers and students to develop comprehensive approaches toward the patients, which will be reflected by health of community in upcoming years.²⁰

Limitations:

Because this study was done online, there is a risk that the results obtained using an offline method will be different in regard to things like assessment results and feedback. The lack of

facilitator participation in online mode in this study, which was conducted during the Covid era, can be improved. The feedback from facilitators was not incorporated in this study, however for implementation of CBL the role of facilitators is also important. In offline mode, better outcomes can be obtained.

Conclusions:

The CBL as TL tool in pharmacology is a learner-centered teaching approach. The results of the study showing effectiveness in the form of improvement in performance score and majority of the students agreed positively (followed by strongly agree) with various aspects of CBL compared to conventional method which they found useful in clinical real-life scenarios and better understanding regarding subject. It shows the acceptability of CBL among students. So, it is concluded that CBL can be used with conventional methods to strengthen the topic and will be a key component of CBME especially in pharmacology.

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