



Developing a Module of Case-Based Learning on Cardiovascular System, Testing and Implementation of it on the Academic Performance of Second Phase Medical Students

Running title: Case Based Learning and impact on second phase MBBS Students

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Abstract:

Objectives: The present study was planned with an aim to develop a module of Case Based Learning on Cardiovascular System and test the Academic performance of second phase medical students. **Methodology:** Prospective Observational study in which the students, divided into two batches, were given equal opportunity to be problem solvers and learn by lecture Methods. A conjoint Assessment was done for both the batches per day on the lecture day after the scheduled lecture with a 25 Multiple choice Question paper test and 5 Structured Short answer Questions. Post analysis feedback by students was taken. **Results:** Our study, indicate that CBL failed to influence the scores of per day analysis of performance assessment in comparison to CTM significantly. However majority of students showed the interest and liking towards Case based learning. **Conclusion:** Case-based learning is remarkably superior to the traditional methods of education but it is recommended that students should be met familiarize with different study skills on their entry to institute. Also, if the instructors become better acquainted with different novel methods of study and teaching there will be improvement in their efficiency, thinking and critical appraisal abilities and also reduction in their stress level. In addition, it is possible that making certain changes and improving learning adaptation, the role of teachers can enhance the short-term effects of CBL.

Keywords: CBL, Case Based Learning, Cardiovascular System, Medical Students, Lecture Method

Introduction

Thistlewaite et al defined case based learning in the following manner as "CBL is a form of inquiry based learning and fits on the continuum between structured and guided learning."⁽¹⁾ Further, He also stated that "The goal of CBL is to prepare students for clinical practice, through the use of authentic clinical cases which links theory to practice, through the application of knowledge to the cases, using inquiry-based learning methods"⁽¹⁾. In another article from Africa CBL is defined as "Case-based learning is structured so that trainees explore clinically relevant topics using open-ended questions with well-defined goals"⁽²⁾. A modern definition of CBL is that CBL is a form of learning, which involves a clinical case, a problem or question to be solved, and a stated set of learning objectives with a measured outcome. ⁽³⁾ And Thus Using clinical cases to aid teaching has been termed as case-based learning (CBL)⁽³⁾.

CBL has been widely implemented as a teaching method to enhance learning by pushing students to work in teams to solve authentic problems, while developing content knowledge, reasoning, and interpersonal skills⁽³⁾. Moreover, the involvement with problem-solving also helps to keep students interest in course material, since students may realize that they are learning skills needed to be successful in the field^(4,5). The emphasis on 'learning by doing' forces students to be conscious of what information is already known about the problem, which information they need to know to solve it and the possible strategies to apply^(6,7,8).

In Traditional; Conventional Traditional Lecture Based method (CTM), students solely receive information from the lecturer and attempt to memorize the content instead of understanding the concepts and using them but still Case-based learning (CBL) is a practice underutilized in many colleges despite having many studies, which demonstrates how Problem solving can positively affect student engagement and retention of the knowledge. The purpose of this review was to improve educational implementation of Case-based learning in the classroom setting which will allow for increases in student engagement. Our study testified the student's retention of knowledge with a formative assessment method which stands as a unique feature of this study and will let us know the impact of Case based learning on students' knowledge retention. The research was focused on developing a module of Case Based Learning on Cardiovascular System testing the Academic performance of second phase medical students which will reveal the importance of implementation of Case based learning as a tool to increase student engagement and retention across the entire educational process.

Aim of the Study:

The present study was planned with an aim to develop a module of Case Based Learning on Cardiovascular System and test the Academic performance of second phase medical students

Objectives of the Study were:

- a. To develop a module of Case Based Learning on Cardiovascular System
- b. To Assess/Measure the impact of Case based learning on students' performance and retention of Knowledge.

Methodology:

The study was a Prospective Observational study and was conducted in the Department of Pharmacology, Nandkumar Singh Chouhan Government Medical College and Associated Hospital, Khandwa (M.P) India. The study was conducted after its approval by Institutional Ethics Committee, NSCGMC Khandwa vide letter no 90/IEC/NSCGMCK/2023.dated 28/07/2023.

Target Population: The batch 2021 students already pursuing the Pharmacology Subject were enrolled in this study.

Study Site: Dept. Of Pharmacology, Nandkumar Singh Chouhan Government Medical College and Associated Hospital, Khandwa (M.P) India

Sample Size: 100-120 batch 2021 students already pursuing the Pharmacology Subject

Consent requirements: Voluntary informed consent was taken by the students.

Study Duration: 6 months.

a. Inclusion Criteria:

All 120 Students already pursuing the Pharmacology Subject were selected in this study. Voluntary informed consent was taken by the students and those willing to participate were included in this study

b. Exclusion Criteria:

Those not willing to participate /absent /had fallen sick during the study period will be excluded from this study

Developing a Module of Case Based Learning on

Cardiovascular System:

A Case based learning module was developed on Pharmacological aspects of cardiovascular system. The module so developed was validated by both external faculties and internally within the department.

Procedure:

- i. The study involved developing a module of Case Based Learning on Cardiovascular System testing the Academic performance of second phase medical students. The module developed was validated
- ii. After this, The study involved role of students and 100-120 students were enrolled in the study of current academic batch (2021 batch) which were divided in two groups of 50- students each as per the practical demonstration Batch A And Batch B. Voluntary informed consent were taken by the students and those not willing to participate were excluded from this study
- iii. Batch A and Batch B were alternatively given the opportunity to be problem-solvers, explore their curiosity, and participate in a collaborative learning experience with their teacher by allocating them Case based learning group and Conventional teaching i.e. lecture teaching methodology for a particular system such as Cardiovascular System related to the subject Pharmacology .
- iv. Batch A were allocated to Case based learning group in one lecture topic and Batch B were allocated to Conventional teaching i.e. lecture teaching methodology for the same lecture topic from Cardiovascular System related to the subject Pharmacology, Vice versa Batch B were allocated to Case based learning group in next lecture topic and Batch A were allocated to Conventional teaching i.e. lecture teaching methodology for the same lecture topic in next lecture from Cardiovascular System related to the subject Pharmacology. Cross over design pattern was followed for the whole cardiovascular system lectures.

Data Collection Methods:

An conjoint Assessment was done for both the batches per day on the lecture day after the scheduled lecture with an 25 Multiple choice Question paper test and 5 Structured Short answer Questions (total 50 Marks Paper) for a duration of 1¹/₂ hour for the same Lecture topic taught on that day and performance of Both the

batches were assessed.

v. Post feedback was taken from both the batches regarding the teaching methodologies and their impact on retention of knowledge and their liking for the teaching methodologies.

vi. Results of per day analysis of performance assessment were further tabulated and were compared in both the groups in i.e. Case based learning group Vs Conventional teaching i.e. lecture teaching methodology.

Process of Validation of Problem based Learning Module:

1. The CBL Module developed was sent for validation and was validated by Faculty of Pharmacology within the institute as well as outside the institute before implementation in the classroom.
2. The question paper developed for conjoint assessment was discussed and validated by

Faculty of Pharmacology within the institute before implementation within the classroom.

Feedback:

Post analysis feedback was taken from both the batches regarding the teaching methodologies and their impact on retention of knowledge and their liking for the teaching methodologies.

Statistical Analysis:

Test score was represented as Mean \pm SD for the marks obtained and Independent t test was applied for testing the significance of Mean Score. P value $<$ 5 %, was considered as statistically significant

Results:

Table 1: Comparative Assessment of Mean Score of CBL and CTM Methods between different topics of cardiovascular system using Independent t Test

Subject (n1, n2)	Case Based learning (n1)	Convention Teaching Method (n2)	Level of Significance
	Mean \pm SD	Mean \pm SD	P value
Drugs Affecting Renin Angiotensin Aldosterone System (57,57)	28.61 \pm 6.68	28.68 \pm 6.31	0.954
Anti-hypertensive Drugs (51,56)	25.07 \pm 4.66	21.03 \pm 4.97	0.000
Anti-Anginal's (56,47)	22.43 \pm 6.38	26.80 \pm 6.77	0.001
Anti-Arrhythmic's (49,59)	19.84 \pm 6.76	26.95 \pm 4.80	0.000
Drugs for CHF (53,57)	19.96 \pm 4.62	18.86 \pm 5.73	0.276
Shock and its Management (35,46)	26.91 \pm 4.95	25.51 \pm 6.54	0.293

Table 1. Reveals various Assessment of Mean Score of CBL and CTM Methods between different topics of cardiovascular system using Independent t Test of this Prospective Observational study between different topics of cardiovascular system taught between the two batches in an alternative cross over design pattern in Case based learning and Conventional teaching Method. On assessment of Anti-Anginal's learning session test mean score was higher (26.80 \pm 6.77) in CTM as compared to CBL (22.43 \pm 6.38). The difference was found to be highly statistically significant as P value $<$ 1 %. Similarly on Assessment of Anti-Arrhythmic's learning sessions, test mean score was higher (26.95 \pm 4.80) in CTM as compared to CBL (19.84 \pm 6.76) which was also found to be highly statistically significant as P value $<$ 1 %. , But On assessment of Anti-Hypertensive Drugs learning session test mean score was higher (25.07 \pm 4.66) in CBL as compared to CTM (21.03 \pm 4.97), . The difference was found to be highly statistically significant as P value $<$ 1 %. In other three learning sessions assessment (Drugs for

CHF, Drugs Affecting Renin Angiotensin Aldosterone System, and Shock and its Management) the difference was not statistically significant as p value $>$ 5 %.

Post feedback was taken from both the batches regarding the teaching methodologies and their impact on retention of knowledge and their liking for the teaching methodologies on a 5 point Likert scale and majority of students showed the interest and liking towards Problem based learning with the clarity of thought and better academic interaction in comparison to conventional teaching classes.

Student Feedback Reflects that Coverage of the Course, also interest development in CBL was much better than CTM, Also academic interaction was much better along with background knowledge provisions which favoured CBL and encouraged CBL as a better teaching learning tool. They found CBL session as more effective in developing analytical, problem solving skills and development of independent thinking.

Table 2: Student Feedback Analysis CBL VS CTM

S.N o.	Features of CBL VS CTM	Student Feedback Evaluation (Total 105 Students)				
		A (very Good)	B (Good)	C (Fair)	D (Poor)	E (No opinion)
1.	Coverage of the Course in CBL VS CTM	55	39	10	-----	1
2.	Sustaining of interest Better in CBL VS CTM	58	40	7	-----	-----
3.	Encouraging academic interaction Better in CBL Than CTM	51	40	13	1	-----
4.	Provision of background knowledge in CBL Sessions	38	40	26	-----	1
5.	The work during the CBL session is adequate and does not induce undue pressure	42	46	15	1	1
6.	The CBL session is effective in enhancing team-working abilities.	52	32	20	-----	1
7.	The CBL session is effective in developing analytical and problem solving skills.	67	31	7	-----	-----
8.	The CBL session is effective in developing independent thinking.	55	37	12	-----	1
9.	The objectives of the CBL session have been fully achieved	41	44	17	3	-----
10.	Clarity and understanding of the faculty's explanation Better in CBL Vs CTM	58	36	10	1	-----

Discussion:

CBL is a pedagogical strategy applies both construct *and* co-construct ideas through social interactions and self-directed learning premised on the belief that effective learning takes place when students actively participate in the learning process. Compared with the traditional didactic method, CBL has several benefits. Firstly, in CBL curricula, students are more actively engaged in their learning compared to traditional teaching where learners may be passive and lose their attention in class. Secondly, CBL is effective to promote application and integration of knowledge, collaboration with partners, and problem-solving ability rather than solely content delivery through the traditional teacher-driven method. Thirdly, CBL format allows for feedback on the case studies and opportunities to discuss issues with experts in the field, whereas, during a lecture, there is little feedback on the learner's comprehension⁽⁹⁾.

In our study, the results indicate that CBL failed to influence the scores of per day analysis of performance assessment in comparison to CTM significantly. However majority of students showed the interest and liking towards Case based learning with the clarity of thought and better academic interaction in comparison to conventional teaching classes. Similar to our findings, some studies showed no significant difference in the exam results between the CBT and TDL groups^(10,11). Some

authors even have reported TDL, CTM in our terms to be superior to CBL and most of their students have reported CBL, fails to impart knowledge or helps in improving their results^(12,13).

The result of our study indicating lack of advantage of CBL over CTM contradicts some previous studies which states that Case-based learning is also considered to promote deep understanding and high-level learning, rather than superficial studying by traditional lectures, whereby learners could conceptualize the knowledge and apply better to novel subjects, rather than rote memorization of lectures⁽¹⁴⁾. Some studies have also observed that supplementing the lectures and exam questions with case scenarios results in a marked improvement in both student participation in class and their performance on exams. This is consistent with the finding of prior reports^(15,16,17).

Our study had certain limitations and many prospects for future considerations. The main limitation that came to our notice was the students disinterest towards assessment taken just after an elaborative session on CBL as well as CTM. Other concern was periodic assessment session after the CBL and CTM lectures. Due to these reasons and students individual perceptions towards assessment many of the students didn't take assessments on a serious note and that came out as a big limitation and concerns in results appraisal. But however majority of students showed the interest and liking towards Case based learning with the clarity of

thought and better academic interaction in comparison to conventional teaching classes. The major prospective earning we earned was that in the process of using CBL, teachers also learned about active learning and teamwork. In addition, they also found that, their ability to organize and express themselves increased and their job satisfaction increased. In terms of student's, student's interest in learning and participation increased.

In general, from our study it may be concluded that there are many challenges that should be addressed right from CBL Module development, its validation and implementation, but Case-based learning is remarkably superior to the traditional methods of education. It is recommended that students should be met familiarize with different study skills on their entry to institute. Also, it is necessary for instructors to become better acquainted with different novel methods of study and teaching so that there is improvement in their efficiency, thinking and critical appraisal abilities and also reduction in their stress level. In addition, although CBL showed no advantage over the traditional methods in the short run, however it is possible that making certain changes and improving learning adaptation, the role of teachers can enhance the short-term effects of CBL in education.

Conclusions:

In general, from our study it may be concluded that there are many challenges that should be addressed right from CBL Module development, its validation and implementation, but Case-based learning is remarkably superior to the traditional methods of education. It is recommended that students should be met familiarize with different study skills on their entry to institute. Also, it is necessary for instructors to become better acquainted with different novel methods of study and teaching so that there is improvement in their efficiency, thinking and critical appraisal abilities and also reduction in their stress level. In addition, although CBL showed no advantage over the traditional methods in the short run, however, it is possible that making certain changes and improving learning adaptation, the role of teachers can enhance the short term Effects of CBL in education.

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