

## Original Research Article

**Combination of traditional teaching and innovative case based learning in biochemistry: A novel approach in medical education.****Dr. Madole M.B.<sup>1</sup>, Dr. Kolpe D.V.<sup>2</sup>, Dr. Mamatha M.T.<sup>3</sup>, Dr. Bachewar N.<sup>4</sup>, Dr. Patel N.<sup>5</sup>**<sup>1</sup>Associate professor, Department of Biochemistry, GMERS. Medical College, Valsad-39600, Gujarat, India<sup>2</sup>Associate professor, Department of Forensic Medicine, M.I.M.S.R. Medical College, Latur 413512, Maharashtra, India<sup>3</sup>Senior resident, Department of dentistry, GMERS. Medical College, Valsad-39600, Gujarat, India<sup>4</sup>Assistant professor, Department of pharmacology, Shri V.N. Government Medical College, Yavatmal-445002, Maharashtra, India<sup>5</sup>Tutor, Department of Biochemistry, GMERS. Medical College, Valsad-39600, Gujarat, India**\*Corresponding author**

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**Abstract:** Lectures continue to be an efficient and standardized way to deliver information to large groups of students. It has been well documented that students prefer interactive lectures, based on active learning principles, to didactic teaching in the large group setting. Case-based learning (CBL) is a constructive active learning paradigm, in which learners select and transform information, construct ideas, and make decisions based on their current or past knowledge. By exploring student experiences, expectations and how they use lectures and CBL or combination of both for academic performance, this study was conducted in GMERS Medical College, Valsad. The first year MBBS students which were participants (n = 150) divided equally into three batches A, B and C with each batch containing 50 students. Batch A students were presented with didactic lectures, B batch students were motivated by CBL and C batch students were taught for the same topic by lecture followed by CBL method. All the batches were evaluated by pre and post test. The students' perception was also studied using a four point Likert scale by questionnaire method. The performance of the students after lectures, CBL and combination of both improved significantly compared to pretest. There is statistically significant improvement in post test scores of students who underwent training for both methods compared to students who underwent single method training. This study indicated that combination method is better and more effective than individual method. Majority of students (97%) agreed for understanding a particular topic, combination of both didactic lectures and CBL sessions were very useful. So we conclude that judicious mixture of didactic lectures and CBL sessions are beneficial as a teaching module in biochemistry and it should be used as a regular method at appropriate places in curriculum of biochemistry.

**Keywords:** Didactic lectures, Case based learning, students' perception, medical education.

**INTRODUCTION:**

The purpose of medical education is to prepare medical students to become competent physicians, critical thinkers, problem solvers, effective collaborators, and self-directed lifelong learners [1]. Biochemistry is a content-rich systematic course of study and a foundational course for future topics in clinical medicine of medical curriculum. It needs to be taught and learned effectively so as to be placed in the context of disease when the medical students graduate and practice in the community [2]. In the traditional system of medical education it is taught in the first year of a four and half years of medical course, along with anatomy and Physiology, with least inter departmental

interaction. It is mainly taught by means of didactic lectures, tutorials, seminars, demonstrations and practical exercises. Such a system is teacher centered with minimal active participation from the students.

During the course of our long education, Students are expected to absorb the material at the scheduled time of lectures, seminars, and practical exercises with little attention paid to the long-term retention of knowledge. Such an approach fosters passivity and a seemingly endless cycle of memorization, regurgitation, and forgetting [3].

When students are actively involved in learning, they retain information longer than when they are passive recipients of instructions in didactic lectures [4]. Active learning approaches are effective in improving learning outcomes in medical education [5]. Among the various strategies proposed to promote active learning, case based learning (CBL) is considered to be effective in stimulating students to synthesize, apply, and integrate basic knowledge in the face of real-life situations. It has been recommended for a variety of clinical subjects, especially in preclinical training years [6].

It is important for future physicians to develop analytic and diagnostic thinking skills early in their program of study so that they are able to correctly apply the facts that they have learned to the solutions of relevant real-world problems [7]. CBL is helpful in this aspect as it is an interactive, student-centered exploration strategy that draws on real-life situations to initiate and promote authentic learning [8].

No study has been conducted to see the effectiveness of combination of didactic lectures with CBL on academic performance of the students in examination. So the aim of our study is to find out whether the innovative CBL is more effective than the traditional didactic lectures or combination of both by comparing the post lecture and post CBL scores with combination of both post scores and also to collect feedback of students' perception on CBL and combination method in biochemistry. Based on the student perception assessment, to find out whether CBL can be incorporated in to our teaching curriculum on regular basis along with didactic lecture.

#### **MATERIAL AND METHODS:**

The study was performed on 150 first-year medical undergraduates of the GMERS Medical College, Valsad admitted during academic year 2015-2016. The teaching module of biochemistry was composed of mainly didactic lectures, tutorials, and practical or demonstration classes. The case-based learning module was introduced during the tutorial class.

We divided the students into three batches (A, B, C) with each batch containing 50 students. Tutorials were held once a week, and, each day, a batch of 50 students came to the class. In the initial class, they were first given an introduction to the technique with merits and demerits of alternative learning modules with an overview how to use the library and internet and how to think analytically. Biochemistry topic with clinical relevance was selected. On this topic test containing MCQs with one best answer was conducted for all three batches. Scores were noted for all three batches. Later

batch A was taught by routine didactic lecture for this topic.

Batch B was divided into five groups containing 10 students each. Batch B was presented with clinical case based on the same topic. The case (Appendix–A) was the clearly defined symptoms of a particular disorder with laboratory data. Students were given time to define, identify, discuss and to resolve the problem. Subsequently, the students were given the specific learning objectives (Appendix–B). The facilitator, during the phase, also motivated and guided the students for learning, by assisting the students through the facts and engaging them in reading to find a possible solution to the problem. Then, during the next session, the case was discussed under the guidance of the facilitator, properly and systematically, taking care to ensure that every student participated in it. Relevant questions were asked by the facilitator, so as to streamline the thought processes and to bring the students back to the main learning objectives, whenever required. Students were also encouraged to ask questions to the facilitator during the session.

Batch C was taught for same topic by routine didactic lecture followed by case based learning method. All the students were evaluated by test containing same set of MCQs conducted previously.

We conducted the same attitude survey to all the students who had used the Innovative Curriculum only and combination of both during the academic year from 2015-2016. The survey asked twelve questions and allowed a free response to one question. A 4 point Likert scale questionnaire containing 12 questions was asked to the students to know their perception on the usefulness of the CBL and its combination with didactic lectures.

#### **Annexure I**

Case:

A 42 year old male executive in multinational company rushed casualty at midnight with complaints of excruciating pain, redness and swelling of the base of the first metatarsophalangeal joint. Patient denies any trauma to the toe and no previous history of such pain in other joints. On examination the joint was swollen, red, warm and tender. His lifestyle includes regular business dinners and alcohol consumption. The doctor on duty treated him with an anti-inflammatory drug (indomethacin) and there was some relief. On blood investigation serum uric acid level was 11 mg/dl. Doctor advised the patient to consume lot of fluids, avoid alcohol and restrict non-vegetarian diet. He was also prescribed to take allopurinol.

**Annexure II**

Specific learning objectives:

- What is normal serum uric acid level?
- What is your probable diagnosis?
- What is the biochemical basis of the symptoms of the patient?
- How would you make a definite diagnosis?
- What is the difference between primary and secondary gout?
- What are tophi?
- What is the justification of hyperuricemia in von Gierke'' disease
- How allopurinol is useful?
- Why the consultant advised the patient to avoid alcohol and non-vegetarian diet?
- What is pseudo gout?

**Annexure III**

Questionnaire:

- Q1. In understanding a particular topic, didactic lectures were very useful
- Q2. In understanding a particular topic, CBL sessions were very useful
- Q3. In understanding a particular topic, combination of both didactic lectures and CBL sessions were very useful.
- Q4. Clinical case given in today's class was interesting.
- Q5. CBL session was very important for development of critical thinking.
- Q6. CBL model was useful in future application of knowledge.
- Q7. CBL session motivated you to learn biochemistry.
- Q8. CBL session Promoted meaningful learning than the didactic lecture.
- Q9. Role of teacher was very important in CBL session.
- Q10. Group discussion during the CBL session was very useful.
- Q11. Training in the CBL sessions will help you in preparing you for the final university examination
- Q12. There should be a judicious mixture of didactic lectures and CBL sessions for the teaching of biochemistry topic with clinical relevance.

**Statistical Analysis:**

Statistical analysis was done by Graphpad Prism software version 5.01. All the results were expressed as mean  $\pm$ S.D. For pre and post test comparison of batch A, B and batch C, paired 't' test was used. One way anova with Tukey's post hoc multiple comparison tests was applied for comparison of all the post test results of batch A, B and batch C. The p value of  $<0.05$  was considered to be statistically significant.

**RESULTS:**

Table 1 shows comparison of pre and post test assessment for batch A, B and C which were presented with didactic lectures, CBL and combination of both teaching modalities respectively. This comparison shows that post test scores for all the three batches were improved and this improvement was statistically significant (P value $<0.001$ ).

Table 2 and Table 3 shows comparison between post test scores of all the three batches with three different teaching modalities having F ratio 127.89 with statistically significant P value  $<0.001$ . It was clearly seen that post CBL scores were improved significantly than post lecture score but combination of didactic lecture and CBL scores were statistically more significant than individual didactic lecture or CBL method.

Majority of students (97%) either totally agree or agree for understanding a particular topic, combination of both didactic lectures and CBL sessions were very useful. All the students agreed that clinical case given in CBL was interesting. Majority of students (94%) opined that CBL session was very important for development of critical thinking. Students totally agreed (85%) that CBL session promoted meaningful learning than the didactic lecture. All the students agreed for judicious mixture of didactic lectures and CBL sessions for the teaching of biochemistry topic with clinical relevance.

**Table 1: comparison of pre and post test assessment for batch A, B and C**

Teaching Method	Pre test score	Post test score	P value	Significance
Didactic lecture(A Batch)	8.62 $\pm$ 1.65	12.24 $\pm$ 1.45	$<0.001$	Significant
CBL(B Batch)	8.78 $\pm$ 1.73	15.14 $\pm$ 1.73	$<0.001$	Significant
Combination of didactic lecture & CBL (C Batch)	8.94 $\pm$ 1.61	17.24 $\pm$ 1.51	$<0.001$	Significant

**Table 2: Comparison of post test score with three teaching methods.**

Variable	Mean score			F Ratio	P value	Significance
	Didactic lecture (batch A)	CBL (batch B)	Didactic lecture+ CBL (batch C)			
MCQ Test	12.24 $\pm$ 1.45	15.14 $\pm$ 1.73	17.24 $\pm$ 1.51	127.89	$<0.001$	significant

**Table 3: Comparison of post test score with three teaching methods (after Tukey's post hoc analysis)**

Mean MCQ Score Comparison	'p' value	Significance
Didactic lecture Vs. CBL	<0.001	Significant
Didactic lecture Vs. Didactic lecture + CBL	<0.001	Significant
CBL Vs. Didactic lecture + CBL	<0.001	Significant

**DISCUSSION:**

There has been always a debate whether a CBL form of teaching module could be conducted in basic science departments of medical education. The key characteristics of CBL include active participation by the students, the development of problem-solving skills rather than memorization [9]. CBL in the biochemistry course will help remind students that what they are learning has relevance in the real world, and may also help motivate students to pay more attention to the numerous facts faced in biochemistry [10].

Based on the assessment test results of our study, it was clear that the CBL methodology had improved the test scores in the study subjects with CBL significantly as compared to the didactic lectures. The feedback data of our study also revealed the fact that CBL had improved learning gains as compared to the traditional didactic lectures. These results are supported by other studies which show improved test scores and learning gains post CBL session [11-14].

We also found statistically more significant improved test scores following combination of didactic lecture with CBL session compared with lecture only and CBL only sessions. This clearly states the usefulness of combination of both methods over single method teaching. Our study is the first study of its own kind to see the effectiveness of combination of both methods (didactic lectures and CBL) on the academic performance of students in the examination. Percentage of students totally in favor of a judicious mixture of didactic lectures and case based learning sessions in tutorial classes was 94%, which suggested that this format was well accepted by first-year medical students. Similar feedback was observed in another research study [9, 15]. Only 3% students disagreed usefulness of combination of both methods for understanding a particular topic in biochemistry.

To make the students understand a particular area of knowledge, the best way is to involve them which can be done by the didactic lectures of particular topic followed by a case on a specific clinical problem based on same topic to be discussed in the tutorial class. In CBL, classroom instructors help students to solve diverse case-based problems that occur in real life situations, moving from abstract knowledge derived from lectures to practical applications. This combination created interest among the students, who were otherwise conversant with didactic lecture classes, which are basically teacher centered.

So, this innovative teaching learning methodology involving didactic lecture along with case based learning served the purpose of giving the students a case and relating it to basic mechanisms in biochemistry and allowing them to handle it analytically.

**CONCLUSION:**

Lectures remain valuable for their efficiency and in giving the students an overview of a particular area of study. On the other hand, it is too teacher centered, with less participation from the students. Case-based learning is effective in encouraging students to take charge of their own learning, define learning objectives by themselves, and learn to work in a group. The drawback of this method at first year is that at this level students are dependent, may be uninterested to learn on their own and not thoroughly aware of pathology and medicine aspects of clinical case. Therefore a judicious mixture of both didactic lectures and case-based learning modules are helpful in coaching the medical students in their first year of training, making them able to undertake self-directed learning, perform best in examinations, and develop the skills of correlating basic science with clinical science in the later years of their training.

**ACKNOWLEDGEMENT:**

We are thankful to the teaching staff, nonteaching staff and students of the first MBBS for their active participation and co-operation in the study.

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