

# Introduction of Case-based Learning as a Teaching/Learning Tool to enhance Students' Knowledge in Biochemistry

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## ABSTRACT

**Introduction:** Case-based learning (CBL) promotes integration of knowledge and practice. During CBL, students are exposed to the real medical problems. The present study was conducted to introduce CBL as a teaching/learning (T/L) tool in the Department of Biochemistry and to determine its effectiveness in enhancing students' knowledge and also to make the students aware of relevance of biochemistry in clinical settings.

**Materials and methods:** After permission from Ethical Committee, both faculty and students were sensitized to CBL; questionnaires and feedback pro forma for students and faculty were finalized. Total of 126 students of first-year Bachelor of Medicine and Bachelor of Surgery (MBBS) were included in the study, and they were divided into two groups. Both groups I and II comprised 63 students each. The study group I (n = 63) was given a clinical problem with specific learning objectives 2 days before CBL session. Pretest questionnaire was administered to both the groups. Group I underwent a CBL session and group II had the same teacher teaching the topic in a didactic lecture form. Both the groups were given a posttest. Crossover of groups was done for the second clinical case. Structured feedback questionnaire on acceptability and usefulness of this method was taken from both the students and the faculty. Using Student's paired and unpaired t-test, the results of pretest and posttest were analyzed.

**Results:** The majority of students (89%) agreed that CBL form of teaching was better than didactic lectures in understanding the topic. For clinical application of knowledge of biochemistry, 85% of the faculty agreed that CBL was a better T/L tool.

**Conclusion:** Among medical students, CBL is effective for better understanding of biochemistry. It motivates students to become self-directed learners. Along with didactic lectures it should be a part of teaching curriculum.

**Keywords:** Biochemistry, Case-based learning, First-year Bachelor of Medicine and Bachelor of Surgery.

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## INTRODUCTION

Biochemistry is one of the foundation subjects in the first-year medical curriculum, having immense importance in understanding the future clinical sciences. It was mainly taught by means of didactic lectures, tutorials, and practical classes in many institutes.<sup>1</sup> It was teacher-centered, with minimal active participation from the students, and hence, the students lacked critical thinking.<sup>2</sup>

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 passively.<sup>3</sup>

A didactic lecture is good for presenting information and providing explanations, but because it lacks active participation, it is not a very effective T/L method.<sup>4</sup> Lecture method of teaching has been much criticized, sometimes to the extent of being called as "lecturalgia." The most important disadvantage associated with didactic lectures is that they are boring and that they cause people to sleep.<sup>5</sup>

Case-based learning is an established pedagogical method that uses case studies as active learning tool.<sup>6</sup> It is closely related to problem-based learning (PBL). The main traits of CBL derived from PBL are that a case, problem, or inquiry is used to stimulate and underpin the acquisition of knowledge, skills, and attitudes.<sup>7,8</sup> Case-based format requires students to recall previously covered material to solve clinical cases, which are based on clinical practice. The clinical case, which is given, acts as a stimulus and so the learner is motivated to gain knowledge. But this process is guided, as the facilitator plays a minimal role, but guides the learner.<sup>9</sup>

So, the present study was conducted with the aim to introduce CBL as a T/L tool in the Department of Biochemistry and to determine its effectiveness in enhancing students' knowledge.

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## Objectives

- To familiarize faculty with CBL.
- To assess perception of faculty and students regarding CBL.
- To make the students aware of relevance of biochemistry in clinical settings.
- To evaluate the effect of CBL on students' learning.

## MATERIALS AND METHODS

The study was conducted in the Department of Biochemistry, Sri Guru Ram Das Institute of Medical Sciences & Research, Amritsar, Punjab, India, during the academic year 2014 to 2015 after taking permission from Institute's Ethical Committee. It is a prospective interventional study.

The faculty of biochemistry department and students of first-year MBBS were first sensitized and faculty members were trained for CBL. Then two case scenarios, one in diabetes mellitus and the other in jaundice, were formulated. Pretest and posttest questionnaires covering the learning objectives were prepared.

Out of 150 students, 126 students gave their consent to be a part of this study. They were divided into two groups: Groups I and II. Both groups I and II comprised 63 students each. The study group I (n = 63) was given a clinical problem. The other group II (n = 63) had the same teacher teaching the topic in a didactic lecture form. Both the sessions were of 2 hours. The interventional group was presented with a clearly defined, short clinical problem on diabetes mellitus. They were given time to define and resolve the problem. Subsequently, the students were given the specific learning objectives. 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. The facilitator, so as to

streamline the thought processes and to bring the students back to the main learning objectives, whenever required, asked relevant questions. Students were also encouraged to ask questions to the facilitator during the session. For the second clinical case on jaundice, a crossover was done, i.e., group II was taught in CBL format and group I in didactic lecture form. Both the groups were evaluated through multiple choice questions (MCQ) test (before and after the intervention) and the results of a pretest MCQ test were considered as the baseline (before intervention).

Structured feedback questionnaires (which were validated by pilot testing) on acceptability and usefulness of this method were taken from both the students and the faculty.

The data were statistically analyzed using Student's paired and unpaired t-test.

## RESULTS

Out of a class of 150 students, feedback was given by 126 (84%). The feedback forms had closed and open-ended questions, with responses on a 5-point Likert scale. The response rate is shown in Table 1. The majority of students (89%) either agreed or strongly agreed that CBL form of teaching was better than didactic lectures in understanding the topic. More than 70% of students felt that CBL form of teaching enhanced their critical thinking and made them self-directed learners. More than 85% of students felt that CBL has made them aware of relevance of biochemistry in clinical settings and found it as a better teaching learning method than the didactic lectures, though more than 92% students agreed that both CBL and didactic lectures should be made a part of teaching curriculum.

The marks scored in the topics covered during the sessions were analyzed by paired and unpaired Student's t-test and a probability of <5% ( $p < 0.05$ ) was considered to be statistically significant. It was observed that the posttest score was highly significantly and higher in both clinical case studies than the pretest score ( $p = 0.000$ ) in

**Table 1:** Student's perception (%; n = 126) on CBL and didactic lecture

Variables	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Understanding of topic by didactic lecture	14	55	26	5	0
Understanding of topic by CBL lecture	45	44	8	2	1
CBL enhanced critical thinking	35	55	7	2	1
Didactic lecture enhanced critical thinking	9	4	32	15	3
Correlation of biochemistry with medicine by CBL	41	45	10	2	2
Correlation of biochemistry with medicine by didactic lecture	13	45	29	10	3
Self-directed learners by CBL	27	46	21	3	3
Self-directed learners by didactic lectures	8	32	36	20	4
CBL a better T/L tool than lecture	0	92	4	4	0
Both CBL and didactic lecture be a part of the curriculum	0	92	5	3	0

**Table 2:** Evaluation of intervention

Case study T/L tool	Diabetes mellitus				Jaundice			
	CBL		Didactic		CBL		Didactic	
No. of students	63	63	63	63	63	63	63	63
Maximum marks	16	16	16	16	20	20	20	20
Test	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Mean $\pm$ SD	7.85 $\pm$ 2.30	10.96 $\pm$ 2.18	7.11 $\pm$ 1.75	9.66 $\pm$ 2.17	8.36 $\pm$ 2.48	15.12 $\pm$ 2.55	9.33 $\pm$ 2.72	12.60 $\pm$ 2.52
p-value	0		0		0		0	

\*p < 0.01 is highly significant; SD: Standard deviation

**Table 3:** Teacher's perception (%) on CBL

Variables	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
In understanding today's topic, CBL session was very useful	88	12	0	0	0
Clinical case given in today's class was interesting	88	12	0	0	0
CBL session was very important in terms of development of critical thinking	88	12	0	0	0
CBL model was useful in future application of knowledge	88	12	0	0	0
CBL session motivated students to learn biochemistry	100	0	0	0	0
Promoted meaningful learning than the didactic lecture	63	12	25	0	0
Role of teacher was very important in CBL session	88	12	0	0	0
Group discussion during the CBL session was very useful	88	12	0	0	0
Would you like CBL to be part T/L tool in future classes	100	0	0	0	0

both types of T/L methods, but when the posttest score of CBL was compared with posttest score of didactic lectures, it was observed that the posttest score of CBL was statistically significantly and higher than the didactic lectures ( $p = 0.003$ , Table 2).

The pass percentage of students who had secured more than 80% marks in posttest in CBL was more than 80%, and in didactic lecture it was more than 70%.

Table 3 shows feedback by the faculty which had closed-ended questions and the responses were on a 5-point Likert scale. More than 85% of the faculty either agreed or strongly agreed on eight out of nine questions.

## DISCUSSION

Case-based learning uses virtual cases to stimulate interest in a particular area of the curriculum. In this study, students as well as faculty perceptions revealed that CBL was very well accepted and it could be used as a T/L tool along with didactic lectures to increase the interest of students in the subject of biochemistry. Some of the other medical education researchers stated that CBL seems to be a good method of teaching, based on results of the evaluation test and feedback questionnaire results, wherein the whole process can be made students-centered.<sup>10,11</sup>

In the present study, it was also observed that the performance of students in the test administered after conducting CBL was better than after the didactic lectures, which was also supported by the student's perception, which revealed that CBL enhanced their critical thinking, and their understanding on the topic became better. A

feedback from students from a study on CBL revealed that CBL was superior in imparting knowledge and cultivating the habit of self-directed learning and group discussions.<sup>12</sup> Case-based learning enhances the ability of the students to work as a team and identify and analyze case histories and find out solution to increase physician competencies, especially in social and cognitive dimensions.<sup>13</sup>

Most of the faculty members felt that this innovative method promoted active participation of the students, which helped them in deep and strategic learning. This finding was also supported by Meyer and Jones.<sup>14</sup> Case-based learning is an active learning tool that enhances clinical correlation and critical thinking, encourages team participation, group discussions, and motivates students to become lifelong learners.

## LIMITATIONS

- The project was introduced to the students toward the end of their first professional course; therefore, only two CBL sessions could be held. The sessions can be introduced early for the next batch of students, giving them more time to enhance learning and introduce more topics to CBL sessions.

## CONCLUSION

There was a positive response shown by faculty to CBL; 100% faculty wanted to hold CBL sessions in future. In clinical settings, 85% of students found the relevance of

biochemistry. It increases interaction between teachers and students. Along with didactic lectures it should be a part of curriculum; 80% of students secured more than 80% marks in posttest after CBL session. So, CBL along with didactic lectures can be used for improving T/L practices in first professional year in the subject of biochemistry, as it gives a more clinical insight into the topic and makes the topic more interesting for the students.

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