

## Original Article

# CBL in Medical Education Effective Learning Methodology than PBL

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## ABSTRACT

The conventional teaching and learning methods in medical education yearns for a change. The newer and effective small group interactive teaching methodologies are being looked into. Problem based learning and case based learning modules were taken into consideration in this study. Although PBL is student centred but it lacks able guidance of the teacher involved and effective participation of all the students. The deficiencies encountered in PBL are taken care of in case based learning study. It is a guided enquiry approach where the teacher plays a vital role in the preparation of the case based problem, organizing the CBL session under his guidance and providing constructive and relevant information during the sessions. Students are the speakers and presenters. Generally, most of the studies refer to the advantages of CBL and PBL in regard to traditional teaching. This study compares the learning effectiveness amongst the two approaches. A total of 126 first year medical students were included in the study. Students were divided into two groups such that both the groups have similar academic knowledge. The effectiveness of the teaching methodologies was reflected in the better performance of the students in the evaluation tests conducted after the said sessions. Both the groups performed better in the evaluation tests conducted after the PBL and CBL session. But the performance was better in the group which attended CBL on the same topic. The difference in the mean marks of the two groups being statistically significant. . However it seems important to develop more consistent research in this field, namely, longitudinal studies with larger samples.

**KEY WORDS:** Case Based Learning, Problem Based Learning, medical Education.

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## Online Access and Article Informtaion

Quick Response code



DOI: 10.16965/ijims.2015.121

International Journal of Integrative Medical Sciences

[www.imedsciences.com](http://www.imedsciences.com)

Received: 03-08-2015

Accepted: 20-08-2015

Reviewed: 04-08-2015

Published: 31-08-2015

Source of Funding: Self

Conflicts of interest: None

## INTRODUCTION

The medical world is abuzz with the idea of reforming the medical education system. The conventional mode of education needs an improvisation so as to impart the expected qualities in the students. For e.g. to inculcate

the problem solving ability, making deductive conclusions and the habit of self study in their life. Although there is no dearth of knowledge resources but the acquisition of the knowledge along with the technical expertise and its timely application in the present health scenario is the

need of present medical education system. The sea of information and knowledge around a student doesn't mean the student has developed the concepts of the subject or he knows how and when to apply it for patient care. Efforts are being made to bridge this gap by the development of various modes of interactive teaching programmes like interactive lecture, problem based learning, and case based learning, tutorials, and interactive seminar sessions and so on. It has been seen that when we work and learn in small groups with interactive sessions, it helps to foster the right spirit and in understanding the subject in a better manner. This in turn leads to confident application of the knowledge acquired. Learning from problems is a condition for human existence. In 1969, PBL was introduced to medical curriculum and has been endorsed as an educational strategy [1]. The findings of this methodology can be traced back to Dewey [2]. It is an important student centric method where the knowledge is better retained with clinical context & integration from the relevant disciplines.

PBL proponents argue that PBL methods encourage lifelong learning, simulate clinical practice, encourage curiosity, and create a broader understanding of the complexity of medicine [3,4]. PBL detractors argue that the PBL process is time inefficient, frustrating for time pressured medical learners, and often leads to erroneous conclusions [5]. Additionally, there is little guarantee that the students will learn how to apply the knowledge necessary for clinical practice in the absence of appropriate clinical direction and as such the presence and expertise of the faculty is wasted if it is not harnessed in more than a passive manner. Also, as PBL requires interactive participation, the students having poor communication skills are likely to lag behind and dominated by the aggressive speakers. Therefore we look for another small group interactive teaching programme so as to provide an alternative to PBL.

Case based learning (CBL) is an educational paradigm closely related to the more common PBL. CBL's main traits are derived from PBL e.g. a case, problem, or inquiry is used to stimulate and underpin the acquisition of knowledge,

skills, and attitudes [6]. However, when learners begin to explore tangents, the facilitators use guiding questions to bring them back to the main learning objective. Hence CBL uses a guided inquiry method and provides a structured small-group session unlike PBL which is an open inquiry approach where facilitators play a minimal role and do not guide the discussion, even when learners explore tangents [7, 8]. Thus, CBL can be summarized as a form of small group learning with the help of case scenarios in the presence of active facilitators. Since the process is case based discussion and fosters deductive reasoning, it can be expected to be a better answer to instill the right spirit amongst the medical students. Additionally, students prepare in advance for the session, and they may ask questions to the local experts during the session which means the facilitators also need to come prepared for the class. Further, CBL proponents argue that CBL helps focus the learners on the key points of a clinical case, and encourages a structured approach to clinical problem-solving. They argue that the facilitators can correct or modify the incorrect assumptions of the learner, which usually does not happen in PBL. Facilitators can moderate the influence of louder, more contributory students and allow everybody to participate in a fair and equal manner. The implementation and assessment of CBL is well documented in various levels of biomedical sciences such as Medicine [9, 10], Geriatrics [11], Nursing [12], Therapeutics and Medicinal Chemistry (13), Pharmaceuticals (14), Obstetrics and Gynecology [15], Anatomy [16], Orthodontics [17] and Allied Health [18]. CBL detractors argue that providing answers to the questions in PBL or even guiding those makes them lax and reluctant to search for the answers. Also, intensive faculty training is required to carry out CBL in a well coordinated manner otherwise it will just become another lecture class. They feel that CBL encourages a spoon-feeding mentality of learners, in which they always expect their peers or teachers to have the correct answers. The acceptability of any model of teaching no doubt relies on the acquisition of knowledge along with the holistic development of the medico with the instillation of right attitude towards their work.

The knowledge enhancement part can be evaluated by the assessments done after the sessions. In this study, an effort was made to estimate the effectiveness of CBL as a knowledge enhancement tool in comparison to PBL method.

**MATERIALS AND METHODS**

The study was conducted in the Department of Biochemistry, Maulana Azad Medical College, New Delhi, India. The program scheduled was traditional lecture class, PBL class and CBL class. 126 first year MBBS students were included in the study. We conducted an evaluation test of 20 marks multiple choice questions before the conventional lecture class and after lecture class with the same question paper. Based on the marks obtained in the exams, we divided the total participants into 2 equal groups and were sex matched such that the means of two group are almost equal (Table no.3). Group-I with 63 students (31 females, 32 males) attended PBL class and group-II consisting of 63 students (32 females and 31 males) attended CBL class. After that an evaluation test was carried out for both the groups with the same question paper. The results were given on the next day of the program.

**RESULTS AND TABLES**

A total of 126 learners including 63 (50%) females and 63 (50%) male students were part of the study. The learners reveal that the CBL system helps to develop their problem solving skills, sharpen up analytic skills and it also helped to develop a better concept of the subject. All these led to arouse their interest in the subject which is manifested in their academic performance. Their academic improvement was measured by their score in the evaluation tests conducted after the PBL and CBL session. After the PBL class, the learners

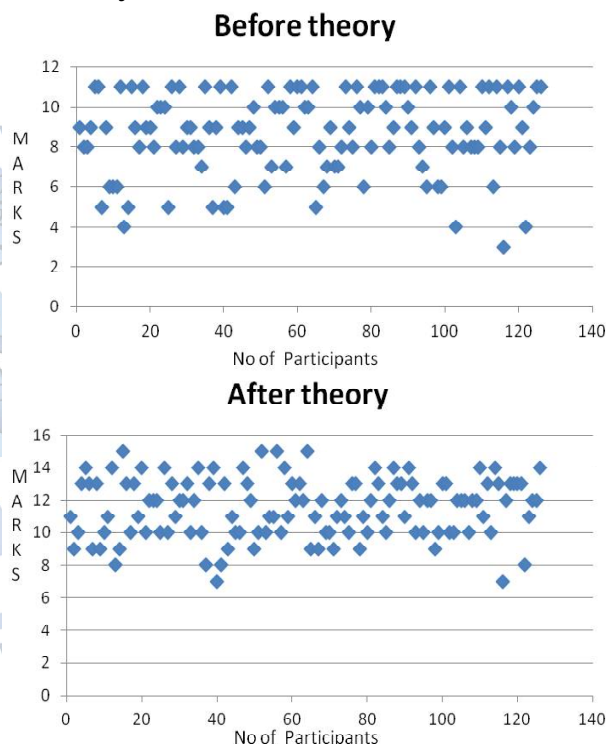
**Table 1:** Shows the percentage (%) of marks obtained in the evaluation test before and after theory.

	Before theory	After theory
<b>Total %</b>	43.49	57.66
<b>Female %</b>	41.75	56.35
<b>Male %</b>	45.24	58.97

**Table 2:** Shows the MEAN and SD of total participants' marks before and after theory.

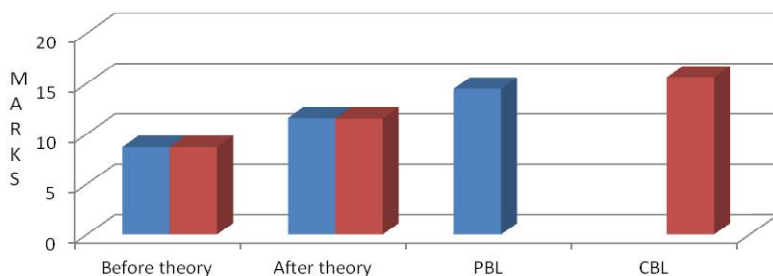
	MEAN	SD
<b>Before theory</b>	8.7	2.03
<b>After theory</b>	11.53	1.83

**Graph 1:** SCATTER PLOTS showing the range of marks obtained in the evaluation test conducted before and after theory.



**Table 3:** shows the MEAN and SD of marks obtained before theory, after theory, post PBL and post CBL in Group-I and II.

	Group-I (No-63)		Group-II (No-63)	
	MEAN	SD	MEAN	SD
<b>Before theory</b>	8.7	2.03	8.7	2.04
<b>After theory</b>	11.56	1.97	11.51	1.7
<b>Post PBL</b>	14.46	1.4		
<b>Post CBL</b>			15.62	1.49



**Graph 2:** Bar diagram showing the MEAN and SD of marks obtained Before theory, After theory, post PBL and post CBL in Group 1 and 2.

scored 72.30% in the evaluation test whereas it was 43.49% before theory and 57.78% after theory. After CBL, attended by the second group, the learners scored 78.10% which was 43.49% earlier (before theory) and 57.54% after theory. Group-II which attended CBL class showed higher percentage of marks than Group-I.

**Table 4:** shows the p-values of marks obtained in the evaluation tests in Group-I and II.

		p-value
<b>Group-I</b>	Post PBL Vs Pre Theory	0.00*
	Post PBL Vs post Theory	0.00*
<b>Group-II</b>	Post CBL Vs pre Theory	0.00*
	Post CBL Vs post Theory	0.00*

\*Statistically Significant

**Table 5:** shows the p-value of the marks obtained by Group-I Vs Group II.

	p-value
<b>Post CBL Vs Post PBL</b>	0.00*

\*Statistically Significant

The comparison of marks obtained in the evaluation tests after CBL and PBL reveals that the mean ± SD values are 15.62±1.49 and 14.46±1.40 respectively. The difference in the two values being statistically significant. The knowledge of learners was significantly increased after the PBL class and CBL session when compared with post theory session in both the groups (p-values 0.00, 0.00, 0.00). But the knowledge level was higher in the post CBL session when compared with post PBL class (p-values 0.00).

## DISCUSSION

The newer innovative teaching learning methods focus on the development of critical knowledge, problem-solving attitude, self-directed learning strategies and team participation skills in the medical graduates. The nidus of the approach is a well constructed clinically oriented question which acts as medium to go through the topic of interest. Some studies have emphasized that it is not necessary to evaluate it on the basis that the approach will always help to match predetermined answers but the focus should be how they defend their proposed solution and the rationale [19,20,21]. We feel a teaching method can be successful and will be able to draw students' attention when it is not only interes-

ting, informative and clinical oriented but is also able to fetch better marks for the students in the examinations and assessment tests.

The newer innovative small group interactive teaching is a better process to learn the medical subject than traditional teaching. Some academicians are of the opinion that the most important purpose of such small group interactive teaching methods is to provide a clinical context for the acquisition of knowledge, rather than to solve the problem [22,23]. Students who have significant deficiencies in expressing ideas or communication skills are likely to be unsuccessful in a PBL program, as PBL requires the ability to process and discuss ideas and learn independently. It thus seems likely that with a guided inquiry approach as in CBL these students might find the problem solving exercises interesting and this might as well improve their academic performance. In this study of ours, we have tried to evaluate the academic effectiveness of PBL and CBL in the form of assessment tests performed after the said sessions. Our form of CBL, an adaptation of that used at UCLA differs from classical CBL in the following major ways:

1. Learning objectives for the session, (these are a subset of objectives from those of the place in the Curriculum in which the CBL resides), are provided to the students before they see the case. However, students do not see the actual case until the CBL session begins.

2. Information in the form of lectures and/or other material is made available to the students prior to the CBL session. This allows some advance preparation to take place before the students see the case. This information will not be enough for the students to master all or possibly even any of the learning objectives during CBL, but it will allow the students to have some knowledge upon which to build during CBL.

It is to be noted that although each CBL module is based on a case, it does not necessarily need to be a clinical case. A basic physiology problem could easily be used as the basis for a CBL case. The use of various innovative teaching methods for imparting undergraduate medical education appears to improve the teaching- learning process for both the teacher

as well as for the students. In the traditional didactic lectures stress is given on teaching alone, so it puts the learner on a passive role. CBL enhances the development of lateral thinking and clinical co-relation. The teaching of biochemistry in medical college is mostly focused on the chemical structure and metabolism of biomolecules [24]. The clinical aspect and relevance of these biomolecules have become a very important part of the teaching module nowadays. The knowledge gained by this traditional method is hardly retained till the clinical teaching starts in the later years. The use of innovative teaching-learning methodology involving CBL can help the students to understand the molecular basis of life in health and disease. Clinical correlation of this knowledge makes the subject interesting and is better retained. Academicians like Surapaneni [25] reported CBL methodology to be a valuable tool in biochemistry. The implementation of CBL in medical education will prepare students as competent primary care physicians. CBL also promotes active participation of the students in learning biochemistry in the context of clinical case and it also helps to improve the diagnostic skills by deductive reasoning [25]. It also overcomes the disadvantages pointed out in PBL as its a guided enquiry approach. The students can participate in a fair manner in the discussion. Students as well as facilitator prepare for this session. The vast scope of interaction and active role of each participant makes CBL more meaningful. Most of the students appreciated this aspect of CBL. This observation is similar to that of Meyer et al [24]. Interactive sessions make students curious, attentive and active participants [26]. CBL also helps to build a concept of the particular topic which is not possible during routine theory classes. This observation is similar to that of Singh et al [27].

The key to case-based instruction is to build up cases that are clear and realistic and encompass all the teaching points the instructor wishes to convey. Constructing such cases can be time consuming. Studies have shown that relative to conventional teaching, case-based instruction significantly improves student retention [28], reasoning and problem-solving skills [29], higher-order skills on Bloom's taxonomy [30],

the ability to make objective judgments [31], the ability to identify relevant issues and recognize multiple perspectives [32], and awareness of ethical issues [33]. Lundeberg and Yadav [34] carried out a meta-analysis and concluded that case based learning have a positive impact on faculty and student attitudes, class attendance, and faculty perceptions of learning outcomes.

**Major findings and final remarks:** Our study indicates that the use of CBL and PBL is well documented in Medical Education. The subjects in basic sciences can be associated with these approaches. This result may be explained by the large amount of literature being published, and because other medical areas like Allied Health and Pharmacy, represent a younger existence when compared with traditional Medical education. While addressing the effectiveness of CBL and PBL as learning vehicles in comparison to traditional didactic lectures, the study also compares CBL and PBL as an effective learning method by focusing on the academic outcomes of students. From the present study it can be concluded that CBL can be used as an innovative teaching method for better retention of knowledge, clarity of subject and application of biochemistry in medicine. This innovative teaching-learning methodology is student centered and achieves greater learner satisfaction.

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**How to cite this article:** Montosh Chakraborty, Shivakrishna Gouroju, Pinki Garg, Karthikeyan P, Prerna Singh. CBL in Medical Education Effective Learning Methodology than PBL. *Int J Intg Med Sci* 2015;2(8):145-150. DOI: 10.16965/ijims.2015.121