

# Case-based learning in pharmacology: Moving from teaching to learning

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## ABSTRACT

**Context:** The knowledge of pharmacology is an important necessity for the prevention and treatment of diseases. The study aimed to find out the beneficial effects of case-based learning (CBL) compare to didactic lecture in pharmacology and to evaluate the perceptions of students regarding the CBL. **Methods:** A total of 68 students took part in the study and were randomly assigned to two equal groups: Group 1 (CBL group) and Group 2 (lecture group). Cases, test items, students feedback questionnaires were developed and peer viewed by experts. Group 1 underwent the CBL and the same topics were handled as a didactic lecture in Group 2 concurrently. Written tests were conducted after completion of each session and the perceptions of students were evaluated. **Results:** The Group 1 showed significantly increased ( $P < 0.001$ ) test score in knowledge-based and critical thinking (clinical application) as compared to Group 2. The perceptions of students were quite positive regarding the CBL as a majority revealed that they has better understanding of concepts (82.35%), self-learning approach (91.17%), critical thinking with integration clinical subjects (97.05%), and active participation in discussion (76.47%) as well as interest in subject (88.24%) through the CBL process. **Conclusion:** Self-learning approach, critical thinking with the integration of subject, and arousal of interest in the subject were positive effects of CBL in the teaching of concepts of pharmacology.

**Key words:** Case-based learning, pharmacology, self-learning approach, undergraduate student

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## INTRODUCTION

Pharmacology is both a basic and an applied science. The traditional/conventional system (didactic lecture) is teacher centered with minimal active participation from the students, minimal or no integration of subject both horizontal and vertical, and the application of knowledge of drug information in actual clinical posting is difficult.<sup>[1,2]</sup> The main traits of case-based learning (CBL) are derived from problem-based

learning (PBL). CBL is a guided inquiry and instructional method within the context of student-centered learning to facilitate students' learning and teach them by the use of case studies.<sup>[3]</sup>

The Medical Council of India, recommendations for graduate medical education in 1997, state that maximal efforts have to be made to encourage integrated teaching between various preclinical and clinical disciplines using PBL/CBL.<sup>[4]</sup> In our institute, pharmacology is mainly taught by means of didactic lectures including tutorials, and practical classes which mainly result in teacher centered, unidirectional learning. While CBL

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inculcate them problem solving skill, increase analytical skill which improve decision making needed for clinical practice. Thus, intervention in the form of introduction of CBL was done in the present study. The objectives of our study were to find out the benefits of CBL in the teaching of pharmacology as compared to didactic lecture, and to evaluate the perceptions of participating students regarding the CBL.

## MATERIALS AND METHODS

After taking Ethical Committee permission, 68 students of MBBS 5<sup>th</sup> semester, selected by convenient sampling were randomly divided in to two equal groups: Group 1 = CBL group, Group 2 = Didactic lecture group. Two cases, e.g., a case of iron deficiency anemia and a case of *Plasmodium falciparum* malaria in pregnancy were selected for teaching through didactic lectures and CBL method.

Cases, test items, students feedback questionnaires were developed and peer viewed by experts from our institute. The case scenario included the clinical problem, history of patient (including personal, family history), laboratory investigations, provisional diagnosis, and treatment chart of the patients. All faculties were trained in CBL session by an organized workshop on CBL. A faculty choose for either CBL session or didactic lecture based on their choice. A meeting of all facilitators was called before start of the study and the salient features of the two cases and their teaching method were discussed. The Group 1 was further randomly sub-divided into two sub-groups CBL-1 and CBL-2 ( $n = 17$  in each groups). CBL-1 and CBL-2 sub-groups discussed the case of iron deficiency anemia and the case *P. falciparum* malaria in pregnancy, respectively. The same topics were taught by didactic lecture as per our teaching schedule (1-h lecture) in Group 2 concurrently.

The CBL involved two sessions. Each has 2 h sessions. In the first session, the group selected a leader and a recorder to lead the session and record all points regarding case, respectively. The case progressed in a stepwise manner, from the known to the unknown facts. The case was chiefly focused on identifying key learning issues, patient problems, investigations, and their treatment from the pharmacology point of view. The

students were encouraged to work and discuss with the group members the pharmacological basis of treatment of the patient with a faculty acting as facilitator. In the second session, all the points were revisited and the doubts of students about the case scenario were clarified by the facilitator. On the other side, didactic group was advised to revise topic on their own.

At the end of each topic, the assessment was conducted for both groups which comprised of 15 short answer questions (7 = knowledge-based, 8 = critical thinking-based), which was same for both group. Assessment was done by faculty who were part of both didactic and CBL teaching, answer sheet of both groups were mixed, and it was not revealed that which student belongs to which group for avoiding bias. Student's perception toward the CBL was evaluated by validated feedback questionnaires statistical analysis was done using unpaired Student's t-test. Scores were expressed as mean  $\pm$  standard deviation and  $P < 0.05$  was considered to be statistically significant.

## RESULTS

The Group 1 showed significantly increased score in both critical thinking- and recall-based questions than the Group 2 [Table 1].

The Group 1 students had extremely positive perceptions about the learning through CBL, the logistics of conduct of the CBL and the facilitation process [Table 2].

## DISCUSSION

Learning through the means of CBL helps students to build on prior knowledge, integrate knowledge, and consider an application to future situations. CBL group of students have increased in both low cognition (knowledge-based) as well high cognition (critical thinking based) test score as compared to a didactic group of students.

A study conducted by Camiah<sup>[5]</sup> proposed that student-centered approaches to education, such as CBL, develop critical (clinical) thinking skills more than teacher-centered approaches by involving self-directed study mode.<sup>[5]</sup> Our study also showed

**Table 1: Test score-knowledge-based (low cognition level) and critical thinking-based questionnaires (high cognition level)**

Topic	Type of questionnaire	Mean score		t*	P
		Group 2	Group 1		
Iron deficiency anemia	Knowledge-based	4.12 $\pm$ 1.04	7 $\pm$ 0.70	10.3	<0.0001
	Critical thinking-based	2.53 $\pm$ 0.99	6.06 $\pm$ 0.75	12.93	
<i>Plasmodium falciparum</i> malaria	Knowledge-based	4.08 $\pm$ 1.06	7.06 $\pm$ 0.75	4.49	
	Critical thinking-based	3.65 $\pm$ 1.10	7.00 $\pm$ 0.79	11.2	

\*Independent sample t-test, Group 1: Students undergoing CBL; Group 2: Students undergoing didactic lecture. CBL: Case-based learning

**Table 2: Student perception about learning experiences, available facility and facilitator about CBL (n=34)**

Questionnaire	Agree (%)	Disagree (%)
Better for understanding basic concepts and get a strong grip in subject compared with traditional lectures	28 (82.35)	06 (17.65)
All the members of group participated in the discussion equally	26 (76.47)	08 (23.53)
Worked as a team and learnt through "trial and error" and vice versa	26 (76.47)	08 (23.53)
The use of clinical case as a learning tool facilitated meaningful progression of self-directed learning	31 (91.17)	03 (8.83)
Working in a groups improve understanding the subjects matter and develop one own diagnosis and treatment plan	33 (97.05)	01 (2.95)
Stimulate to see the real life cases and investigate further issues of particular interest	30 (88.24)	04 (11.76)
Using electronic resources, primarily the internet, to find information was easy	32 (94.12)	2 (5.88)
Library resources other than electronic ones were accessible	33 (97.05)	1 (2.95)
Use of computer as investigative tool in the library was beneficial	27 (79.41)	07 (20.59)
Facilitator did not dominate group discussion	26 (76.47)	08 (23.53)
Facilitator created supportive group climate	30 (88.24)	04 (11.76)
Facilitator followed progress of concerned individuals	29 (85.29)	05 (14.71)
Encouraged involvement in group members	30 (88.24)	04 (11.76)
Facilitator kept the group focused on the task	30 (88.24)	04 (11.76)
Facilitator addressed the group problems when asked	31 (91.17)	3 (8.83)

\*Figure in parenthesis showed percentage (%). CBL: Case-based learning

that 91.17% of students agreed that CBL provides self-directed learning approach. Another study conducted by Silverman<sup>[6]</sup> stated that CBL provides students with the opportunity to ask important analytical questions, consider various responses, and argue for or against various situations. Similarly in our study data shown that 97.05% students agreed that working in groups improve understanding the subjects matter and develop critical (clinical) thinking that make one own diagnosis and treatment plan.

Jonassen<sup>[7]</sup> showed CBL starts with real-life problems found in clinical workplaces, and relies on the active engagement of students to think about determining possible solutions. In our study on 76.47% students agreed that they actively participated and worked as a group during the CBL. Majority of students appreciated this method of learning as they could better understand basic concepts and get a strong grip of the subject (82.35%). Regarding infrastructure and environment of learning, 97.05% students agreed that they had good resources and internet facility available in the library. 86.76% students opined that faculty as a facilitator role was very helpful, interactive, and supportive in nature. Hence, this aroused their interest in learning the subject.

## CONCLUSION

Self-learning approach, better understanding basic concepts, critical thinking with integration of subject, and arousal of interest in the subject were the preliminary positive effects of the introduction of CBL in the teaching of concepts of pharmacology. Moreover, the positive perceptions of students' indicate that the implementation of CBL in the Pharmacology curriculum in our institution will be a successful endeavor.

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## Conflicts of interest

There are no conflicts of interest.

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