

## Problem-Based Learning (PBL) As A Teaching-Learning Strategy To Supplement The Knowledge Of Pharmacology In Medical School Undergraduates.

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**Abstract:** Background: PBL as a teaching-learning strategy is progressively being incorporated into the medical curriculum. Problem-based learning (PBL) provides the forum for the students to solve the given problem and in the process students learn content knowledge and also develop problem-solving skills, reasoning skills, communication skills, and self-assessment skills. It has evoked a substantial interest and debate in medical teaching in recent years.

**Method:** Conventional didactic lectures were taken on certain CNS topics. This was followed by two tests; first one was a short answer question test and a second one was based on PBL strategy. The difference in their score was statistically analysed.

**Results:** Scores of the two tests were compared and statistically analysed by using Student's *t* test. Marks scored by the students for PBL test were higher than those scored in the SAQ test; this difference was statistically significant. A score of  $t > 1.96$  is considered significant mean change; our calculation showed the  $t = 10.1$  which is highly significant.

**Conclusion:** Intelligent combination of both traditional and PBL curricula could prove to be the best and most effective methodology for training medical school undergraduates.

**Key words:** Hybrid technique, medical pedagogy, problem-based learning, problem-solving skills, teaching-learning strategy.

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### I. Introduction

Medical education has been progressing by leaps and bounds. Many innovative teaching-learning methods have been introduced in the past to make the medical undergraduate curriculum simple, interesting and clinically oriented. Problem based learning (PBL) is one such method.

PBL was pioneered in the medical school program at the McMaster University in Hamilton, Ontario, Canada in the late 1960s by Howard Barrows and his colleagues. PBL has been incorporated into medical curriculum for quite some time now and today it forms an integral part of medical pedagogy. It aims to conceptualize and contextualize medical education by integrating clinical sciences with the preclinical and paraclinical sciences. Howard Barrows (1996) lists the six original core characteristics of PBL (1).

1. Learning is student-centred .
2. Learning occurs in small student groups.
3. Teachers are facilitators or guides or tutors
4. Problems form the original focus and stimulus for learning.
5. Problems are a vehicle for the development of clinical problem-solving skills.
6. New information is acquired through self-directed learning.

Since the undergraduate medical curriculum is vast and challenging; to fathom it, medical education should include innovative methods of teaching and learning which will serve to instruct and teach the students in a way that will help them imbibe the knowledge and skills in an enjoyable, interesting and student-friendly study environment. PBL also will help students develop their problem-solving skills and become self-directed learners (2).

According to Hal White "One must reconsider what students really need to learn and the environment in which they learn. Much of the enthusiasm for the problem-based approach to learning comes from instructors who feel revitalized by the creative energy it releases" (2).

Problem-based learning (PBL) provides the forum to the students to solve the problem and in the process, students learn content knowledge and also develop problem-solving skills, reasoning skills, communication skills, and self-assessment skills (2)

According to Thomas R. E. there are four key objectives in the education of doctors, namely motivating learning, develop clinical reasoning, structuring knowledge in clinical contexts and developing self-learning skills (3).

Pharmacology is a vast subject hence difficult to grasp and remember. Didactic classroom lectures form the cornerstone of teaching medical curriculum in undergraduates in the present scenario. PBL may serve to supplement the classroom didactic lectures in a big way by helping the students to understand, memorise and recall. Hence we decided to introduce problem-based learning strategy to motivate students to think and reason out rationally. This will enhance their knowledge and understanding of the subject.

## II. Materials and Methods

We conducted a study based on the PBL strategy in the department of Pharmacology, Goa Medical College. Ninety nine students participated in the study. The conventional didactic classroom lectures on the concerned topics i.e

1. Opioid pharmacology,
2. Drugs used in migraine,
3. Anticonvulsants,
4. Antiparkinsonian drugs and
5. Drugs used in the treatment of Alzheimer's disease

were taken as per the lecture schedule. This was followed by a formal announcement regarding the dates for the two tests which were to be held subsequently. The announcement was made 30 days before the first short answer questions (SAQ) test. The first test was based on short answer questions, while the second test was based on the problem-based learning strategy. Both were based on the topics mentioned above. Following the two tests, feedback forms were given to the students.

### Ethical aspects

Approval for conducting the study was obtained from the Institutional Ethical Committee of the Goa Medical College, Bambolim, Goa.

## III. Results

Scores of the two tests were compared and statistically analysed by using Student's t test. Marks scored by the students for PBL test were higher than those scored in the SAQ test; this difference was statistically significant. A score of  $t > 1.96$  is considered significant mean change; our calculation showed  $t = 10.1$  which is highly significant.

**Table 1: Difference in the scores of PBL test and SAQ test**

Serial number	Di	fi
1	-1	5
2	0	6
3	1	17
4	2	16
5	3	15
6	4	12
7	5	6
8	6	7
9	7	5
10	8	5
11	9	1
12	10	3
13	12	1

di = difference in PBL and SAQ test marks

fi = number of students

## IV. Discussion

PBL is probably the most innovative learning strategy conceived in the history of education (4). PBL represents a paradigm shift from traditional teaching and learning philosophy (5). It has evoked a substantial interest and debate in medical teaching in recent years (6). In our study, the students scored higher marks in PBL tests as compared to SAQ test. Many factors may have contributed to such a result. Several studies have demonstrated that PBL is an educational strategy which is beneficial for integrating knowledge, motivating students and enabling them to adapt learning activities to their own needs and interest (7, 8). Albanese and Mitchell in their study found PBL more nurturing as compared to conventional method (9). PBL facilitates

acquisition of knowledge of pharmacology by making the learning process enjoyable (10). PBL involves backward reasoning as opposed to forward reasoning in other methods and embeds student's learning process using real life problems rather than imparting mere content knowledge (4, 9). Our study was an effort to combine conventional teaching and PBL strategy. The didactic lectures followed by the SAQ test involved the conventional teaching-learning method. This enabled the students to gain the basic knowledge of Pharmacology. This was followed by the PBL test which facilitated a rational and sagacious combination of conventional and PBL approaches (11). This method helps to have a hybrid technique in order to overcome the drawbacks of either methods used alone (12). It is obvious that we cannot entirely do away with classroom didactic lectures because they help to clear difficult concepts, make students aware of the fundamentals of the concerned topic, and allow useful student-teacher interaction. In our study the PBL test was an enjoyable exercise as opposed to conventional tests. Freedom to discuss in a group and write the answers as a group made it a stress-free exercise. They found it more nurturing and enjoyable. It also helped them to develop reasoning skills rather than just memorising by rote.

Thus it pointed to the possibility that students' cognitive performance in clinical application is enhanced more with PBL test compared to routine SAQ test.

PBL is an excellent strategy for teaching pharmacology to students to make them effective problem-solvers, self-directed learners and promote group work. It also helps to develop their clinical reasoning and enhance the intrinsic motivation in them. PBL is an active learning process as compared to conventional didactic classroom lectures which are usually associated with passive learning. In PBL the students are divided into small groups and each group has to answer the question given in the form of a clinical problem. According to Hoffman K et al, it was observed that changes in the curriculum to accommodate PBL showed improved and higher performance by medical students who graduated. These changes helped to better equip the medical graduates with knowledge and skill to function better within the complex health care system (13).

Schmidt (1983) describes the process of PBL as seven steps

1. Clarifying and agreeing on terms and concepts that are unclear.
2. Define the problem and the review terms which need more depth of explanation.
3. Analyse, brain storm and create potential hypothesis.
4. Discuss, evaluate and organise possible explanation into potential hypothesis .
5. Generate and prioritise learning objectives, divide research workload.
6. Private study time to research objectives.
7. During next tutorial, report back gained information, create an explanation and synthesise new information to the problem. ( 14)

PBL is thus an important educational strategy which helps to integrate the preclinical and paraclinical subjects with clinical curriculum, motivate and inspire the students and finally help them to identify their learning issues and set their own learning goals (7). The active process of imbibing knowledge is superimposed on prior knowledge that they already possess.

In PBL the command over the basic knowledge is acquired by solving problems so fundamental information is learnt in the same setting and context in which it will be used. In a nutshell the intelligent combination of both traditional and PBL curricula could prove to be the best and most effective methodology for purpose of training medical school graduates (15).

## V. Conclusion

PBL is a useful tool that can enhance self-directed learning and improve the students' problem-solving skills. It can help to encourage development of intrinsic motivation amongst students by generating interest and curiosity about the topic on which the problem is based. Since PBL is a group activity it introduces the student to team work, task sharing and helps develop key interpersonal skills. PBL strategy amalgamated with classroom lectures will enthuse students to undertake self-directed learning and help make learning student-centred and enjoyable. This will foster and nurture scientific temper and subsequent learning. Thus PBL should eventually become the cornerstone of medical curriculum.

## References

- [1]. Barrows, Howard S. (1996). "Problem based learning in medicine and beyond : A brief overview". *New Directions for teaching and learning*.
- [2]. *Speaking of Teaching*. Stanford university newsletter on teaching. Winter 2001 vol. 11, no. 1
- [3]. Thomas R.E., PBL: Measurable outcomes. *Med edu*. 1997 Sept; 31(5):320-9
- [4]. Woei Hung, David H Jonassen, Rude Liu. Problem based learning. Problem based learning approach- AECT. Accessed from [www.aect.org/ed tech/edition 3/ER5849x\\_CO38\\_fm.pdf](http://www.aect.org/ed tech/edition 3/ER5849x_CO38_fm.pdf)
- [5]. CHAKRAVARTHI, Srikumar; NAGARAJA, H.S; JUDSON, John Paul. An exploration of the strategic challenges of PBL in medical Education Environment: A Paradigm shift from traditional lectures. *Indian Journal of Science and technology, [S.I]*, p.216-221, Feb 2010.ISSN 094-5645.

- [6]. DA Kilroy. PBL Review. *Emerg. Med J* 2004; 21:411 -413 doi :10.1136/emj 2003.012435
- [7]. Beta, Phoebe. PBL- A critical review of its educational objectives and the rationale for its use. *Saudi Med J.* 2001 : April 22 (4):299-305
- [8]. Dolmans D H, Gijseleers WH, Schmidt HG, Vander Meer SB. Problem effectiveness in a course using PBL. *Acad Med* 1993 March : 68(3): 207-13
- [9]. Albanese MA, Mitchell S. PBL – A review of literature on its outcomes and implementation issues. *Acad Med* 1993 Jan 68 (1): 52-81
- [10]. Sivam SP, Iatrides PG, Vaughn S. Intergration of Pharmacology into a PBL curriculum for medical students. *Med edu* 1995 July: 29(4 ) 289-96
- [11]. Chang G, Cook D, Maquire T, Shakun E, Yakimeti WW, Warnock GL . PBL its role in undergraduate surgical education. *Can J. Surg.* 1995 Feb, 38(1): 13-21
- [12]. Carrera LI, Tellez TB, D'Ottavia AE. Implementing a PBL curriculum in an Argentinian Medical School: Implications for developing countries. *Acad Med* 2003 Aug (8) 798-801
- [13]. Hoffman K, Hosokow M, Blake R J, Headrick L, Johnson G. PBL outcomes, ten years of experience at University of Missouri-Columbia school of Medicine. *Acad Med* 2006 July ; 81 (7): 617-25.
- [14]. Schmidt, H.G (1983) Problem based learning: rationale and description. *Med Education* 17 (1) 11-16
- [15]. R.S. Donner, H. Bickley. PBL in American Medical Education: An overview. *Bull Med. Library Assos:* 1993 July 81 (3) 294-296