

# Is problem-based learning a better teaching-learning tool for emergency obstetric care for undergraduate medical students?

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## ABSTRACT


**Background:** Clinical emergency management requires critical thinking, interpersonal skills in addition to content knowledge of the clinical issue. Problem-based learning (PBL) as a teaching-learning method for clinical emergency case scenarios has not been analyzed separately in the medical literature. **Objectives:** The objectives of the study were to compare learning outcomes and perception of medical graduates for lecture-based learning (LBL) and PBL for emergency obstetric care. **Materials and Methods:** In a randomized controlled study, 34 medical students participated in a LBL group ( $n = 16$ ) or PBL group ( $n = 18$ ). Lecture class of 1 h or PBL method was used for teaching “eclampsia.” Pre-test and post-test questionnaires were administered to both groups. Perception about PBL method was collected by closed-ended (Likert scale) and open-ended questionnaire. **Results:** Mean pre-test score of the PBL group was significantly lower than that of the LBL group (5.5, SD 2.2 vs. 7.2, SD 2.7;  $P = 0.048$ ). Mean post-test score in the PBL group was higher than that of the LBL group (13.1, SD 1.6 vs. 12.1, SD 1.1;  $P = 0.064$ ). Difference in mean of pre-test and post-test score was more in the PBL group (7.6 vs. 4.9). Students perceived PBL as a better method for teaching obstetric emergencies as it promotes collaboration with fellow students (17, 94.5%) and critical thinking (15, 83.3%). Majority (16, 88.8%) of students preferred a hybrid curriculum. **Conclusion:** While knowledge gain in PBL is at least at par with LBL, PBL is perceived as a better and more effective method for learning obstetric emergencies.

**KEY WORDS:** Education; Medical; Problem-based Learning; Curriculum; Eclampsia

## INTRODUCTION

Traditional teaching in the form of lecture is the most commonly used method for teaching and training. This method, despite having its own advantages of delivering information to a large extent to a large group in short time, lacks the ability to stimulate students for self-learning and critical analysis in clinical case

scenarios.<sup>[1]</sup> Sir William Osler in 1899 recommended that students should be allowed more time to study replacing the lecture time and emphasized teacher’s role in helping students to observe and reason.<sup>[2]</sup> In 1932, the Commission of Medical Education of American Colleges stated that “Medical education should develop sound habits as well as methods of independent study and thought which will equip the students to continue their self-education through life.”<sup>[3]</sup> Subsequently, in 1969, McMaster University of Canada adopted problem-based curricula,<sup>[4]</sup> which were followed in many parts of the world. Recently, due to the expansion of biomedical information with ubiquitous presence of technology permitting rapid access to medical information, the need for problem-solving skills and self-directed learning has been emphasized.<sup>[5]</sup>

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Problem-based learning (PBL) is student centered and “involves small groups of students discussing some trigger material (the problem), determining what they need to study, and then meeting again to share results of their learning.”<sup>[6]</sup> Different studies have reported that students exposed to PBL curriculum have better interpersonal skills, psychosocial knowledge, and attitude toward patients.<sup>[7]</sup> Furthermore, PBL improves the students’ ability in developing critical thinking, lifelong learning, and problem-solving skills.<sup>[8]</sup>

A comparative study for teaching “evidence-based medicine” to undergraduate students showed that PBL was less effective in imparting knowledge than lecture-based learning (LBL).<sup>[9]</sup> However, better examination performance of the students was found in the PBL group as compared to traditional teaching in psychiatry.<sup>[10]</sup> More recently, a higher score was obtained in the PBL group compared to lecture-based methods when two topics were taught by these two methods in a cross-over study.<sup>[11]</sup> Although PBL as a teaching-learning method has been explored and applied for routine medical teaching in varying circumstances, it is not yet specifically used for teaching clinical emergency care.

Clinical emergency management requires critical thinking, interpersonal skills in addition to content knowledge of the clinical issue. Understanding strength and weakness of PBL as a teaching-learning method for clinical emergency case scenarios is vital before its wider application. Therefore, the current study was planned to explore the impact of PBL method on students’ knowledge and learning gain about an obstetric emergency (eclampsia) and evaluate their satisfaction and perception about the method in a teaching hospital of Eastern India. Learning outcomes and perceptions regarding PBL were compared with that of traditional LBL method.

## MATERIALS AND METHODS

The present study was conducted at ESI Post Graduate Institute of Medical Sciences and Research and ESIC Medical College, Kolkata, India, from September 1, 2015, to January 31, 2016. Forty students of the third-semester MBBS were recruited for the study. We explained to them the details of the study design and the process of PBL. Following written informed consent, they were randomized by simple randomization technique into two groups. Each group, Group I (LBL group) and Group II (PBL group), comprised 20 students. Group II (PBL group) was further divided into two batches, each with 10 students to maintain the small group norm of PBL. Each student was asked to fill the pre-test questionnaires in a printed format, which consisted of 16 multiple-choice questions and a total score of 20 marks. The LBL group was taught by a traditional lecture class of 1 h on an obstetric emergency – “eclampsia” – using a PowerPoint presentation. At the end of the lecture, students were asked to answer the post-test questionnaires.

The students from the PBL group were given “a trigger” with a case scenario of “eclampsia.” Then, the problem was discussed and the learning objectives were formed in the presence of a facilitator. These students reassembled after 1 week. The problem was reiterated once again, and the learning objectives were answered by the students themselves and the final answers were disclosed by the facilitator. All these students were asked to provide feedback on a structured format along with the answers to post-test questionnaires. The feedback format comprised a total of 10 questions, of which 8 were closed-ended questions on Likert scale of 5 and the remaining 2 were open-ended questions. This study was approved by the Ethics Committee of ESIC Medical College, Kolkata, India [Figure 1].

Data were collected and entered into Microsoft Office Excel. Mean and standard deviation were calculated from the scores of pre-test and post-test of both the groups and were compared using Student’s *t*-tests. The difference was considered to be statistically significant if  $P < 0.05$ . Stata 7.0 (Stata Corporation, Texas, USA) statistical package has been used for statistical analysis.

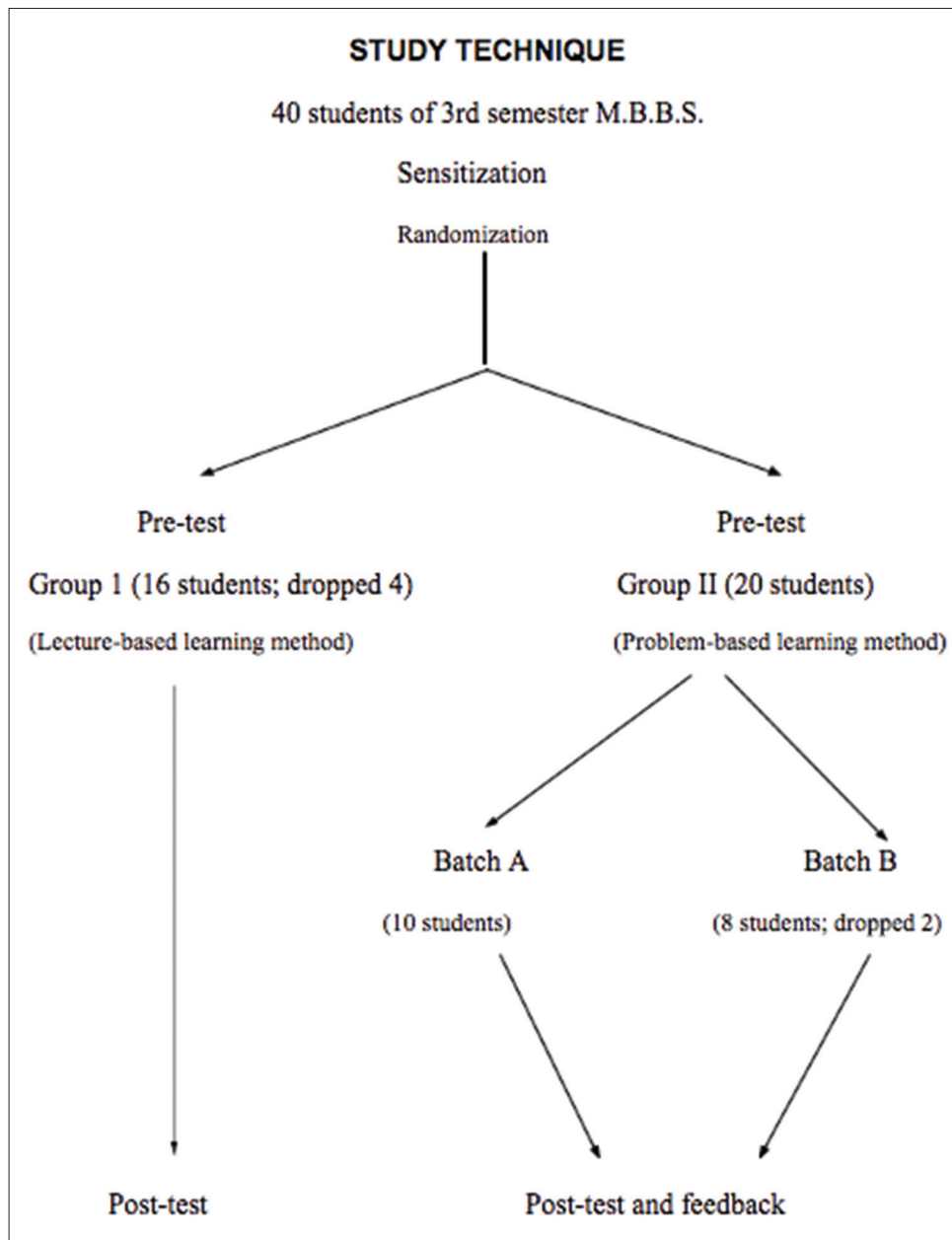
## RESULTS

A total of 40 MBBS students were recruited for the study and were randomized into two groups comprising 20 students in each group. A total of six students dropped out, four from Group I and two from Group II. Therefore, 16 students participated in Group I (LBL group). In Group II (PBL group), 20 students participated in the first session while only 18 students participated in the second session (flow diagram). Baseline information of participants of both groups is summarized in Table 1.

The mean score of pre-test of the PBL group was significantly lower than the mean pre-test score of the LBL group (5.5, SD 2.2 vs. 7.2, SD 2.7;  $P = 0.048$ ). Mean of post-test score in the PBL group was higher than that of control group, although it was not statistically significant (13.1, SD 1.6 vs. 12.1, SD 1.1;  $P = 0.064$ ). However, the difference in mean of pre-test and post-test score was higher in the PBL group as compared to the LBL group (7.6 vs. 4.9). Hence, absolute gain of scores was more in the PBL group [Table 2]. In addition, the highest

**Table 1:** Baseline information of the MBBS students in two groups

Characteristics of participants	Lecture-based learning (n=16) (%)	Problem-based learning (n=18) (%)
Mean age in years (SD)	20.2 (0.7)	19.7 (0.8)
Marks obtained in the first professional MBBS examination (%)		
60–65	3 (18.7)	8 (44.4)
66–70	7 (43.7)	4 (22.2)
>70	6 (37.5)	6 (33.3)



**Figure 1:** Study protocol

score in the PBL group was 16, which was higher than that of the LBL group (13.5).

In the PBL group, the overwhelming majority of students (17, 94.5%) perceived that PBL was a better method than LBL method and it encouraged collaboration with fellow students. Moreover, 15 (83.3%) students agreed that PBL promotes critical thinking in the learners. Similarly, 15 (83.3%) students agreed that PBL is better than traditional LBL method for teaching clinical emergency case scenarios. However, 2 (11%) students were neutral to this statement and 1 (5.5%) student disagreed on this statement. Majority (11, 61%) of the students expressed that it should replace didactic lecture. Interestingly, 16 (88.8%) students agreed that PBL should be implemented in combination with traditional LBL method. Only 3 (16%) students perceived

PBL to be more time consuming while the majority disagreed to this statement.

### Responses to Open-ended Questions

The open-ended questions were as follows: (a) What is your opinion about PBL? (b) How do you compare PBL with conventional teaching-learning and why? In thematic analysis, all the students perceived PBL positively and stated it as a more interesting method than lecture-based teaching. It was expressed that it generated critical thinking, self-learning, and in-depth learning [Table 3]. A few examples from the responses from open-ended questions are interesting to note:

- a. One student expressed that (“conventional learning does not encourage one to go back home and study on

**Table 2:** Pre-test and post-test scores of the MBBS students – lecture-based learning versus problem-based learning

Variables	Lecture-based learning		Problem-based learning		P-value
	Number of participants	Mean (SD)	Number of participants	Mean (SD)	
Pre-test score	n=16	7.2 (2.7)	n=20	5.5 (2.2)	P=0.048
Post-test score	n=16	12.1 (1.1)	n=18	13.1 (1.6)	P=0.064

Mean difference between pre-test and post-test scores in lecture-based learning group:  $P=0.000$ . Mean difference between pre-test and post-test scores in problem-based learning group:  $P=0.000$

**Table 3:** Analysis of open-ended questions (number of participants, 18)

*Themes/categories	Number of responses
PBL is better than conventional teaching	11
PBL encourages self-study more understanding	4
PBL is more interesting way of learning	8
PBL promotes self-study	3
PBL promotes collaboration, i.e., fellow students	7
PBL encourages critical thinking	7
PBL is more interactive way of learning	7

\*These themes were emerged during qualitative analysis of the responses to open-ended questions. As responses were widely variable according to the participants' perception, only repetitive responses were tabulated. PBL: Problem-based learning

the given topic but in PBL, I personally feel that I have opened the books and gained some extra knowledge which I can implement in future”).

- b. The other student expressed that (“It is an innovative technique, which is more interactive and engaging, hence better for modern age learners, for whom information is available at a click. It encourages the student to develop problem-solving skill and hence, can be a confidence booster”).
- c. Furthermore, one student expressed that (“It helps to cultivate more knowledge rather than same old boring lecture”).
- d. Another student stated that (“...it brings out in us the desire to gain more knowledge”).

## DISCUSSION

The evidence regarding efficacy of PBL on knowledge acquisition in medical education had been varied. Difference between the LBL and PBL has been explored earlier with varying results, which could be attributed to subject matter, content of the subject, and method of evaluation.<sup>[9-11]</sup> The scope of PBL in context of emergency care in medical or obstetric conditions, where prompt recall of knowledge and response is vital in addition to critical thinking and interpersonal skills, has not been explored in earlier studies. In the present study, mean pre-test score in the PBL group was significantly lower

than the mean pre-test score of the LBL group (5.5, SD 2.2 vs. 7.2, SD 2.7;  $P=0.048$ ), which is an incidental finding. However, this trend was reversed in post-test scores which were higher in the PBL group, although not statistically significant (13.1, SD 1.6 vs. 12.1, SD 1.1;  $P=0.064$ ). The improvement of mean score (post-test minus pre-test) was 2.7 points higher in the PBL group than the traditional group (7.6 vs. 4.9). These results indicate that PBL method is more effective compared to the traditional LBL method, and the participants are likely to be at an advantage if taught by PBL method.

Impact of PBL on knowledge domain has been variously reported from being less effective to more effective than traditional teaching-learning methods<sup>[9,10]</sup> Johnston *et al.* compared PBL with LBL for teaching “evidence-based medicine” to undergraduate students in an Asian environment and concluded that PBL was less effective in imparting knowledge than the LBL group.<sup>[9]</sup> Contrary to this, McParland *et al.* compared learning styles and attitudes toward psychiatry and showed better examination performance of students in the PBL group as compared to traditional teaching.<sup>[10]</sup> However, no difference was noted in learning styles and attitudes toward the subject.<sup>[10]</sup> Recently, a cross-over study involving teaching two topics by PBL and lecture-based method has revealed a trend toward higher score in the PBL group.<sup>[11]</sup> These findings are similar to the present study where higher mean post-test scores in the PBL group, although not statistically significant, suggest that knowledge gain was at least at par in both the groups. In a comparative study, the PBL students performed significantly better in clerkship performance and more importantly, in no situation did they performed worse than the standard.<sup>[12]</sup> However, in the current study, performance of the students in the actual clinical situation was not studied. Comparing our results with that of other studies, we need to emphasize the fact that context, content and methods of evaluation are very different among the studies. The current study, although small, is unique because the observations are based on evaluation using different teaching methods/tools for teaching-learning of an obstetric/clinical emergency condition. This is hardly ever explored by comparable teaching methods, and its findings can be extrapolated to a wide range of clinical teaching settings, where emergency care is needed.

Students' perception is an important factor for the utilization of educational technology and resources, and it is considered as the most realistic indicator in educational evaluation.<sup>[13]</sup> In



the current study, majority of the students perceived PBL as a better method compared to LBL. This is in concurrence with the previous Indian study, in which medical students perceived PBL as a better learning tool than traditional lectures in basic science subjects.<sup>[14]</sup> Furthermore, 17 (94.5%) students in the PBL group of the present study expressed that it helped them to collaborate with fellow students and encouraged critical thinking. In addition, nearly 95% of the students perceived that PBL encourages problem-solving behavior. Similarly, prior studies from India revealed that PBL was perceived positively by the medical students as a useful instructional tool for promoting collaboration, self-directed learning, reasoning, and problem-solving skills.<sup>[15,16]</sup> However, PBL was perceived as more time consuming by 4 (16.6%) students, which is lower than the prior report (44.4%) from South India.<sup>[15]</sup> This difference could be attributed to difference in study environment and characteristic of the participants.

The PBL participants prefer small group learning.<sup>[17]</sup> Similarly, in the present study, students of the PBL group expressed preference for small group learning with a facilitator. They also expressed that PBL sessions encouraged them for self-study. These findings are similar to earlier review, where PBL graduates rated themselves better than their conventional learning counterparts in terms of self-directed learning, information gathering skills, problem-solving skills, and interpersonal skills.<sup>[18]</sup> Majority (16, 88.8%) of the students opted for hybrid curricula in the current study. Bhattacharya *et al.* evaluated PBL method for one module of physiology for the 1<sup>st</sup> year undergraduate medical students and found that 87% of the students preferred integration of PBL with conventional teaching, which is similar to the present study.<sup>[19]</sup> Recent literature also supported the fusion of different methods of learning to suit students' need.<sup>[5]</sup>

In the current study, the students often expressed PBL sessions interesting and enjoyable [Table 3]. Enjoying the subject increases motivation, which is the key to enhance learning in different learning domains. These findings were supported by the earlier study, which highlighted rapid development of expertise of the 1<sup>st</sup> year of PBL residents in emergency room.<sup>[20]</sup>

The PBL method as a learning tool has an edge over other methods due to its potential to address critical thinking, self-directed learning, collaboration, and interpersonal skills besides knowledge gain. Fraser and Greenhalgh had suggested that evaluation of learning outcomes of PBL should focus on ability to work effectively in an unfamiliar context, rather than evaluating skills and knowledge.<sup>[21]</sup> Considering this, the evaluation by any kind of written post-test may not be adequate and sensitive tool to test the effects of PBL on different learning domains. Therefore, mere score of the post-test may not truly reflect the efficacy of PBL method for teaching clinical emergency as in the present study. However, from the positive perception of the participants, as

assessed by open- and closed-ended questionnaire method, it is envisioned that PBL method is likely to be a better method for teaching clinical emergencies. Lechner in a review stated that students' perception of their learning experience should be the focus of education evaluation and is the most reliable indicator of program success.<sup>[13]</sup> Makoul *et al.* also enforced that student's perceptions are valid criteria in curriculum evaluation.<sup>[13,22]</sup> In the present study, positive perceptions of the PBL group suggest a probable program success with this teaching and learning method. In the present study, the positive perceptions of students, toward PBL as a teaching-learning method for clinical emergencies, may be considered as a likely indicator of program success.

These above-mentioned findings are pertinent for medical education in India, which is currently based on traditional teaching method. This will help us to appraise the need for introducing PBL in the present medical education system of India and other Asian countries. This will also facilitate integrated learning which is recommended by the Medical Council of India.<sup>[23]</sup> However, issues have been raised such as unfamiliarity of students and teachers to a new tool and resource constraints for implementing PBL in India.<sup>[24]</sup> The authors suggest that PBL should be adopted as an instructional tool for teaching clinical emergency case scenario in the current medical curricula to induce sensitization of both teachers and learners for adequate capacity building in addition to imparting a better learning experience to students. Hence, it will further facilitate implementing PBL in a wider scale. However, the present study has its limitations due to small sample size and time constraints. Parameters such as self-directed learning, more confidence in solving problems, collaboration with team, and critical thinking cannot be assessed by one post-test evaluation, and it requires a long-term follow-up without any diffusion effect. However, such diffusion effects are difficult to control as exchange of ideas and information among the students cannot be restricted.<sup>[13]</sup>

This study has a few strengths and limitations. It is a randomized control trial involving a common and complex clinical emergency, requiring critical thinking about a wide spectrum of medical complications associated with this disease. It also demands teamwork. This study also adopted both quantitative and qualitative methods, which helped us to explore the students' perception, an integral part of assessing any teaching-learning process. However, the limitations of the study were – small sample size and testing involved only one clinical emergency. Therefore, further studies are required to establish its generalizability to other clinical emergencies.

## CONCLUSION

The current study shows that knowledge gain in PBL is at least similar, if not better than LBL. In addition, the students perceived PBL as a better and more effective method for

learning obstetric/clinical emergencies than the LBL. They expressed that PBL generates critical thinking, self-learning, and in-depth learning and also encourages collaboration with fellow students. Therefore, there is a need for introducing PBL for teaching clinical emergency care in the current medical curricula in Asian countries. In the future, larger longitudinal studies will be required to assess the impact of PBL on the learners' problem-solving behavior/skill while dealing with wide range of clinical emergencies.

## REFERENCES

- Sadeghi R, Sedaghat MM, Sha Ahmadi F. Comparison of the effect of lecture and blended teaching methods on students' learning and satisfaction. *J Adv Med Educ Prof* 2014;2:146-50.
- Osler W. An introductory address on examinations, examiners, and examinees. *Lancet* 1913;2:1047-50.
- Rappleye WC. *Medical Education: Final Report of the Commission on Medical Education*. New York: Association of Medical Colleges, Commission on Medical Education; 1932. p. 173-4.
- Neufeld VR, Woodward CA, MacLeod SM. The McMaster M.D. Program: A case study of renewal in medical education. *Acad Med* 1989;64:423-32.
- Schwartzstein RM, Roberts DH. Saying goodbye to lectures in medical school paradigm shift or passing fad? *N Engl J Med* 2017;377:605-7.
- Clark CE. Problem-based learning: How do the outcomes compare with traditional teaching? *Br J Gen Pract* 2006;56:722-3.
- Nandi PL, Chan JN, Chan CP, Chan P, Chan LP. Undergraduate medical education: Comparison of problem-based learning and conventional teaching. *Hong Kong Med J* 2000;6:301-6.
- Amin Z, Khoo HE. Problem-based learning: Concept and rationale. In: *Basics in Medical Education*. 2<sup>nd</sup> ed. Singapore: World Scientific; 2009.
- Johnston JM, Schooling CM, Leung GM. A randomised-controlled trial of two educational modes for undergraduate evidence-based medicine learning in Asia. *BMC Med Educ* 2009;9:63.
- McParland M, Noble LM, Livingston G. The effectiveness of problem-based learning compared to traditional teaching in undergraduate psychiatry. *Med Educ* 2004;38:859-67.
- Khoshnevisasl P, Sadeghzadeh M, Mazloomzadeh S, Hashemi Feshareki R, Ahmadiafshar A. Comparison of problem-based learning with lecture-based learning. *Iran Red Crescent Med J* 2014;16:e5186.
- Distlehorst LH, Dawson E, Robbs RS, Barrows HS. Problem-based learning outcomes: The glass half-full. *Acad Med* 2005;80:294-9.
- Lechner SK. Evaluation of teaching and learning strategies. *Med Educ Online* 2001;6:4529.
- Jagzape AT, Srivastava T, Quazi N, Rawekar. A Problem-based learning as a learning tool: Learners' perspective of an Indian medical school. *Natl J Physiol Pharm Pharmacol* 2015;5:291-5.
- Joseph N, Rai S, Jain A, Nelliyanil M, Kotian SM. Perception towards problem based learning among medical students of a private medical college in south India. *Br J Med Med Res* 2015;9:1-10.
- Nanda B, Manjunatha S. Indian medical students' perspectives on problem-based learning experiences in the undergraduate curriculum: One size does not fit all. *J Educ Eval Health Prof* 2013;10:11.
- Smith HC. A course director's perspectives on problem-based learning curricula in biochemistry. *Acad Med* 2002;77:1189-98.
- Schmidt HG, Vermeulen L, van der Molen HT. Longterm effects of problem-based learning: A comparison of competencies acquired by graduates of a problem-based and a conventional medical school. *Med Educ* 2006;40:562-7.
- Bhattacharya N, Shankar N, Khaliq F, Rajesh CS, Tandon OP. Introducing problem-based learning in physiology in the conventional Indian medical curriculum. *Natl Med J India* 2005;18:92-5.
- Kuhn GJ. *Designing Problem-based Instruction to Foster Expertise in Emergency Medicine Residents [dissertation]*. Detroit (MI): Wayne State Univ; 1998.
- Fraser SW, Greenhalgh T. Coping with complexity: Educating for capability. *BMJ* 2001;323:799-803.
- Makoul G, Curry RH, Thompson JA. Gauging the outcomes of change in a new medical curriculum: Students' perceptions of progress toward educational goals. *Acad Med* 2000;75:S102-5.
- Medical Council of India. *Recommendations of the Workshop on Need-based Curriculum for Undergraduate Medical Education*. New Delhi: Medical Council of India; 1992.
- Chandramohan P. *Medical education in India at crossroads: Issues and solutions*. *Arch Med Health Sci* 2013;1:80-4.

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