

PBL facilitator training focusing on the skills of promoting student critical thinking

Lubna Ibrahim Al Asoom (✉ lasoom@iau.edu.sa)

Research article

Keywords: Problem-based learning, critical thinking, medical education, faculty development, debate, hypothesis, role-play

Posted Date: May 12th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-27347/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background Critical thinking is an essential skill for medical graduates. The aim of the following study is to train the facilitators to boost critical thinking during the PBL sessions.

Method Forty PBL facilitators of the college of Medicine, the year 2019-2020, were invited to fill a questionnaire and participate in a workshop. The questionnaire measures the background knowledge of the facilitators about critical thinking. The workshop started with a presentation then followed by exercises to apply different techniques for critical thinking.

Results Most of the facilitators (>80%) believe that PBL supports critical thinking. > 50% are using questioning technique. None were aware of any other technique. Following the workshop, > 50% were able to suggest other relevant techniques such as debate, hypothesis and role play. Most of the facilitators admired the activity and requested similar training sessions.

Conclusion Facilitators training workshop needs to be tailored toward specific PBL outcomes. Critical thinking is one of the most important targets of PBL. However, facilitators of previous facilitation experience and exposure to general PBL workshops lack the skills to support critical thinking. The currently focused workshop yields promising reflection by the participants' feedback and performance.

Background

With the rapid advancement in the world health system and the increment of its complexity, there is a growing need to prepare the medical graduates to be critical-thinkers[1]. Hence, most medical schools have incorporated critical thinking as one of the top outcomes of their curricula. Modern pedagogical strategies were adopted in order to promote critical thinking[2, 3]. Critical thinking can be defined as the ability to evaluate the information, the data, and the situations, analyze it, and formulate or synthesize a conclusion or decision[4]. Problem based learning (PBL) is a pedagogical approach that is widely adopted in medical schools. It started first in the medical school of McMaster university of Canada in the late 1960. Later, it disseminated to most medical schools as well as other disciplines[5]. The PBL teaching is designed into two sessions. During the first session, the students are provided with a problem in the form of case scenario. The students with the help of their tutor are required to read the problem, discuss it, analyze it and try to identify their learning gaps. The students are allowed period (probably a week) to search for their tasks from authentic sources. In the second session, the students rediscuss the problem and consolidate their knowledge armed with the required knowledge from their search[6].

The process of PBL teaching aimed to develop multiple learning outcomes such as the development of critical thinking, collaborative learning, searching skills, long life learning, leadership skills and integration with other learning opportunities[7]. PBL teaching strategy required the provision of the design and execution to maintain the quality of the process and achieved the targeted objectives. The design started by identifying the learning objectives, writing the problem, training the tutors, assessment of the students, and evaluation of the process and reflection[8, 9].

In the college of medicine, Imam Abdulrahman Bin Faisal university, Dammam, Saudi Arabia an integrated problem-based learning curriculum was launched in 2014. Tutor training was one of the most important concerns. A program of regular workshops was established. An anticipatory workshop at the start of each semester was planned. The workshops were organized to deliver a holistic training toward the whole PBL process, or a specific session targeting the training toward one learning outcome. In the current study, we have planned a training session aimed to explore the background of the tutors in regard the impact of PBL on promoting critical thinking, investigate their current practice, discuss some techniques to provoke critical thinking and provide them with training opportunity through exercises to apply these multiple techniques.

Methods

The current work and study were approved by the deanship of college of medicine, and received ethical approval from the institutional ethical committee of deanship of scientific research in Imam Abdulrahman Bin Faisal University with ethical number (2019-01-293).

Forty faculty members from the college of medicine, who participated in PBL facilitation in the first semester, academic year 2019–2020 were invited to participate in the study and requested to fill a study consent. A questionnaire was sent to those who submit their consent. The questionnaire included two set of questions, one is related to the basic data such as age, gender, duration of experience in PBL facilitation, and number of PBL workshops attended. The second included questions related to the role of PBL in developing critical thinking, some are in the form of open-ended question and others in 5- Likert scale (Table 1).

Table 1

Facilitators' responses to questions that measures the general knowledge about the role of PBL in promoting critical thinking.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
PBL teaching strategy can promote the critical thinking of the students	3 (9%)		1 (3%)	9 (29%)	18 (58%)
The structure and design of the problem is an important factor in promoting students' critical thinking	2 (6%)	1 (3%)		7 (23%)	21 (68%)
The student internal motivation and academic achievement is important in the development of critical thinking	2 (6%)			13 (42%)	16 (52%)
The facilitator role is important in promoting student critical thinking	2 (6%)		3 (9%)	6 (19%)	20 (65%)
The facilitator role in probing questions during the PBL session fosters the development of student critical thinking	2 (6%)	1 (3%)		4 (13%)	24 (77%)
The facilitator role in giving short-explanatory notes during the PBL session is important in promoting student critical thinking	3 (9%)	3 (9%)	5 (16%)	11 (35%)	9 (29%)
The facilitator role in encouraging a well-organized debate is important in promoting student critical thinking	2 (6%)		3 (9%)	8 (26%)	18 (58%)
The facilitator role in encouraging a well-organized role-play is important in promoting student critical thinking	2 (6%)	1 (3%)	5	11 (35%)	12 (39%)
The facilitator role in encouraging the student to propose a hypothesis and search for evidence is important in promoting student critical thinking	2 (6%)		2 (6%)	11 (35%)	16 (52%)

During the day of the workshop 15 minutes presentation was delivered. It includes an introduction of the significance of critical thinking as an outcome for the modern curricula. The role of the PBL in promoting critical thinking was highlighted through presenting positive and negative findings of international researchers and educationist. The factors that might influence the effectiveness of PBL program were discussed. The significance of tutor training was emphasized and particularly in relation to the enhancement of student critical thinking. Multiple pertinent pedagogical techniques that can be practiced by the tutor during the PBL session was introduced. These techniques were recommended in order to foster the development of critical thinking of the students. The presentation was concluded actively, by sharing a group of clinical scenarios (short problems), and the audience were requested to propose the most relevant technique. Last part of the workshop included an individual-based exercise. Each candidate

was asked to select the most relevant pedagogical techniques among six listed techniques for four examples of problems (Appendix 1).

All the attendants were asked to report their evaluation of the workshop.

Data were analyzed using SPSS version 24. Correlation was assessed using Pearson correlation. A significant level was considered when P-value is < 0.05 .

Results

Among the forty invited PBL facilitators, 31 responses were received. 48% (15) of the participants were male, and 52% (16) females. The age ranges from 30–65 with an average of 45 years old. The academic rank includes 3 lecturer, 21 assistant professor, 6 associate professor, and one professor. Twenty-nine are medical graduates with MBBS degree and two with science background. Subspecialties include physiology (12), anatomy (7), biochemistry (3), Family and community medicine (4), Microbiology (2), pharmacology (1), pathology (1), and general surgery (1). Number of years of participating in PBL facilitation ranges from 1 to 6 years with an average of 3.5 years. Number of PBL training workshop ranges from 1–8 with an average of 2.6 (mode = 1, median = 2). All the questionnaire responses are summarized in Table 1. Answers to the opened question: “What are the techniques used by the tutor to promote student critical thinking” are presented in Table 2. Methods used by the tutor to assess the students critical thinking are presented in Table 3. The participants’ response to the workshop exercise is presented in Table 4. By the end of the activity, all participants demonstrated positive attitude toward the workshop, they described the activity as focused, well designed and addressing an important concept. Furthermore, they admired the concept of tutor training toward a specific objective such as critical thinking. They manifested preference of training sessions toward each specific objective of the PBL. General training workshops might overlook some of the essential elements and objectives expected from PBL teaching.

Table 2
Techniques suggested by the participants in the questionnaire to foster critical thinking:

Suggested technique	Number of responses
Probing questions	15
Encouraging discussion and brain storming	12
Promoting the generation of ideas and hypothesis	1
Linking to their previous knowledge	1
Encouraging the use of drawings and diagrams	1

Table 3
Methods suggested by the facilitators to assess the student critical thinking:

Suggested method	Number of responses
Through written test (MCQs, questions)	3
Clinical reasoning exam, clinical scenario based MCQs	6
By observing their participation in the discussion, linking to previous knowledge, and analysis of the case	12
By evaluation of their presentation and preparation of the tasks.	2
Evaluation of their background knowledge	1
Do not know	6

Table 4
Participants' response to the workshop exercise: (29 participants submitted their answer proforma)

	Questioning	Linking to previous knowledge	Using concept map	Generation of hypothesis	Debate	Role play
Problem 1	25 (86%)	27 (93%)	6 (21%)	2 (0.07%)	0	0
Problem 2	18 (62%)	22 (76%)	17 (59%)	7 (24%)	15 (52%)	7 (24%)
Problem 3	14 (48%)	19 (66%)	1 (0.03%)	18 (62%)	15 (52%)	1 (0.03%)
Problem 4	12 (41%)	12 (41%)	5 (17%)	9 (31%)	11 (38%)	21 (72%)

Discussion

Critical thinking is an essential competency for medical graduates[10]. Medical curricula must be well-designed and well-equipped with teaching opportunities that promote critical thinking[11]. Evidences from the literature supported that critical thinking can be systematically taught. Most educators encouraged teaching critical thinking in context that provide a medium of integration of multiple source of knowledge. The learners are advised to explore all related information, and possible solutions or decisions, avoid cognitive bias and premature closure of discussion[12, 13].

One of the most widely used pedagogical method to promote critical thinking is problem-based learning PBL[14]. PBL is widely used by the medical schools. The influence of PBL on the development of student critical thinking was the concern of many educators. Several studies using a variety of tools to measure the impact of PBL on student critical thinking have been identified[15]. At the University of Hong Kong, 79 first year undergraduate students were randomly assigned to either traditional lecturing method or PBL.

The critical thinking disposition was measured by California Critical Thinking Disposition Inventory (CCTDI) in 4 timepoints and student perception of their learning experience by individual interviews. PBL group demonstrated a significant improvement in CCTDI as compared to their counterparts of the traditional teaching and to their scores at the start point. In addition, the students' perception toward the experience was positive[16]. In a study in china, 102 third year medical students at Perking University, were tested for their critical thinking disposition using CCTDI and PBL evaluation forms. All the students showed positive scores in CCTDI with an average of 297.72. CCTDI score showed also positive correlation with the PBL evaluation scores[17]. Furthermore, the performance of 193 medical students at Al Nafees medical school, Islamabad, Pakistan in a higher cognitive and clinical reasoning exam was improved after one-year PBL program[18]. However, some practices showed discouraging findings in regard the effect of PBL in the domain of higher cognitive function and critical thinking. Using CCTDI to test the critical thinking disposition in 76 undergraduate students before and after the exposure to PBL teaching revealed no significant difference in their scores[19]. Although PBL is recognized as a good medium to nurture student critical thinking. This teaching opportunity needs extensive collaborative and coordinated efforts to ensure the quality of the problem scenarios, the skills and enthusiasm of the tutors, the readiness of the students and the alignment with the learning environment[20].

In the current study, we focused on the tutor training as an important element toward the success of PBL in nurturing critical thinking. We aimed to explore the background of the PBL tutors and their awareness of the role of PBL in promoting student critical thinking, as well as train them to utilize multiple techniques during the PBL session to elicit critical thinking.

The participated PBL tutors have been exposed to several PBL workshops and practicing PBL facilitation for up to 6 years. Most of them (above 80%) agreed toward the role of PBL in promoting critical thinking. More than 80% believe that the structure and design of the problem, the tutor skills and the student self-motivation and academic achievement have a significant impact on the development of student critical thinking. Probing questions and encouraging discussion was the most used method by the tutors. Although most of them agreed that other methods such as debate, role play and framing a hypothesis can be used in PBL sessions to promote critical thinking, none of them propose these methods in the open-ended question. More than 30% disagreed regarding the effectiveness of role play in promoting critical thinking and 64% accept giving short explanatory notes (mini lecturing) during the PBL sessions. The duration of practicing PBL facilitation, seniority, or number of attended PBL workshops did not reflect better practices or responses. Specific training that targeted the improvement of tutor skills toward individual PBL learning objectives is essential[21, 22]. In the current study, the tutors were trained specifically to utilizes different techniques during the PBL sessions in order to foster the student critical thinking. The tutors have enjoyed the activity and were interested to learn these different techniques including; questioning, linking to previous knowledge, using concept mapping, formulating hypothesis, debate, and role play. They reflected positively on the relevance of these techniques to different clinical inquiries and their impact on the dynamic of the PBL session. Utilizing a variety of techniques during facilitating PBL ensures successful interaction, and deep learning. It also maintains fruitful interesting atmosphere[23]. Majority of the tutors (> 50%) were able to suggest the most relevant technique per

scenario during the activity session. Most of the tutors requested similar workshops in the future. Further follow up and reinforcement of the implementation of these techniques in the PBL sessions is recommended. Student feedback can be sought to explore the impact of this workshop on the tutor performance, and in specific toward utilization of different techniques to inculcate critical thinking.

Conclusions

Realizing that the tutor skills and training is an important element for the success of PBL teaching. Specialized training workshop that target each expected PBL outcome is essential to address the importance of that outcome, and to provide the tutor with multiple practical tools and techniques. Critical thinking is one of the main outcomes of PBL teaching. It can be augmented by a skillful tutor who motivate the students by different techniques such as probing questions, linking to previous knowledge, debate, role play, and synthesizing hypothesis. The current study reflects a successful design of specialized PBL-tutor workshop as perceived by the participants' feedback and their performance.

Abbreviations

PBL Problem based learning

CCTDI California Critical Thinking Disposition Inventory

Declarations

Ethics approval and consent to participate

Not applicable

Ethics approval and consent to participate

The study was approved by the Institutional Ethical Committee of the Deanship of Scientific Research in Imam Abdulrahman Bin Faisal University with ethical number (2019-01-293).

All participants submit an electronic written consent.

Consent for publication

Not applicable

Competing interests

The author has no conflict of interest.

Funding

There was no fund for the current work.

Availability of data and materials

All Data are available with the author and can be provided upon request.

Authors' contributions

LIA is the sole author of this manuscript. LIA is responsible for conceptualization, design, data collection and manuscript writing. LIA has read and approved the manuscript.

Acknowledgements

The author would like to thank all the participants for their response and active engagement.

References

- [1] Z. C. Y. Chan, "A systematic review on critical thinking in medical education," (in eng), *Int J Adolesc Med Health*, vol. 30, no. 1, Apr 2016, doi: 10.1515/ijamh-2015-0117.
- [2] E. Barroga and H. Mitoma, "Critical Thinking and Scientific Writing Skills of Non-Anglophone Medical Students: a Model of Training Course," (in eng), *J Korean Med Sci*, vol. 34, no. 3, p. e18, Jan 2019, doi: 10.3346/jkms.2019.34.e18.
- [3] S. A. Azer, "Use of portfolios by medical students: significance of critical thinking," (in eng), *Kaohsiung J Med Sci*, vol. 24, no. 7, pp. 361-6, Jul 2008, doi: 10.1016/S1607-551X(08)70133-5.
- [4] M. M. Hayes, S. Chatterjee, and R. M. Schwartzstein, "Critical Thinking in Critical Care: Five Strategies to Improve Teaching and Learning in the Intensive Care Unit," (in eng), *Ann Am Thorac Soc*, vol. 14, no. 4, pp. 569-575, Apr 2017, doi: 10.1513/AnnalsATS.201612-1009AS.
- [5] N. Bodagh, J. Bloomfield, P. Birch, and W. Ricketts, "Problem-based learning: a review," (in eng), *Br J Hosp Med (Lond)*, vol. 78, no. 11, pp. C167-C170, Nov 2017, doi: 10.12968/hmed.2017.78.11.C167.
- [6] R. W. Jones, "Problem-based learning: description, advantages, disadvantages, scenarios and facilitation," (in eng), *Anaesth Intensive Care*, vol. 34, no. 4, pp. 485-8, Aug 2006, doi: 10.1177/0310057X0603400417.
- [7] D. H. J. M. Dolmans, S. M. M. Loyens, H. Marcq, and D. Gijbels, "Deep and surface learning in problem-based learning: a review of the literature," (in eng), *Adv Health Sci Educ Theory Pract*, vol. 21, no. 5, pp. 1087-1112, Dec 2016, doi: 10.1007/s10459-015-9645-6.
- [8] E. Bate, J. Hommes, R. Duvivier, and D. C. Taylor, "Problem-based learning (PBL): getting the most out of your students - their roles and responsibilities: AMEE Guide No. 84," (in eng), *Med Teach*, vol. 36, no. 1, pp. 1-12, Jan 2014, doi: 10.3109/0142159X.2014.848269.

- [9] D. F. Wood, "Problem based learning," (in eng), *BMJ*, vol. 336, no. 7651, p. 971, May 2008, doi: 10.1136/bmj.39546.716053.80.
- [10] S. A. Azer, A. P. Guerrero, and A. Walsh, "Enhancing learning approaches: practical tips for students and teachers," (in eng), *Med Teach*, vol. 35, no. 6, pp. 433-43, Jun 2013, doi: 10.3109/0142159X.2013.775413.
- [11] V. C. Lucia and S. M. Swanberg, "Utilizing journal club to facilitate critical thinking in pre-clinical medical students," (in eng), *Int J Med Educ*, vol. 9, pp. 7-8, Jan 2018, doi: 10.5116/ijme.5a46.2214.
- [12] S. Sahoo and C. A. Mohammed, "Fostering critical thinking and collaborative learning skills among medical students through a research protocol writing activity in the curriculum," (in eng), *Korean J Med Educ*, vol. 30, no. 2, pp. 109-118, Jun 2018, doi: 10.3946/kjme.2018.86.
- [13] D. P. S. R. Carvalho, A. F. Vitor, A. L. P. Cogo, V. E. P. Santos, and M. A. Ferreira, "Theory of communicative action: a basis for the development of critical thinking," (in eng|por), *Rev Bras Enferm*, vol. 70, no. 6, pp. 1343-1346, 2017 Nov-Dec 2017, doi: 10.1590/0034-7167-2016-0383.
- [14] U. Khoiriyah, C. Roberts, C. Jorm, and C. P. Van der Vleuten, "Enhancing students' learning in problem based learning: validation of a self-assessment scale for active learning and critical thinking," (in eng), *BMC Med Educ*, vol. 15, p. 140, Aug 2015, doi: 10.1186/s12909-015-0422-2.
- [15] L. N. Kong, B. Qin, Y. Q. Zhou, S. Y. Mou, and H. M. Gao, "The effectiveness of problem-based learning on development of nursing students' critical thinking: a systematic review and meta-analysis," (in eng), *Int J Nurs Stud*, vol. 51, no. 3, pp. 458-69, Mar 2014, doi: 10.1016/j.ijnurstu.2013.06.009.
- [16] A. Tiwari, A. Avery, and P. Lai, "Critical thinking disposition of Hong Kong Chinese and Australian nursing students," (in eng), *J Adv Nurs*, vol. 44, no. 3, pp. 298-307, Nov 2003, doi: 10.1046/j.1365-2648.2003.02805.x.
- [17] D. Pu *et al.*, "Influence of critical thinking disposition on the learning efficiency of problem-based learning in undergraduate medical students," (in eng), *BMC Med Educ*, vol. 19, no. 1, p. 1, Jan 2019, doi: 10.1186/s12909-018-1418-5.
- [18] M. Asad, K. Iqbal, and M. Sabir, "EFFECTIVENESS OF PROBLEM BASED LEARNING AS A STRATEGY TO FOSTER PROBLEM SOLVING AND CRITICAL REASONING SKILLS AMONG MEDICAL STUDENTS," (in eng), *J Ayub Med Coll Abbottabad*, vol. 27, no. 3, pp. 604-7, 2015 Jul-Sep 2015.
- [19] H. Choi, "[The effects of PBL (Problem-Based Learning) on the metacognition, critical thinking, and problem solving process of nursing students]," (in kor), *Taehan Kanho Hakhoe Chi*, vol. 34, no. 5, pp. 712-21, Aug 2004, doi: 10.4040/jkan.2004.34.5.712.
- [20] J. Jin and S. M. Bridges, "Educational technologies in problem-based learning in health sciences education: a systematic review," (in eng), *J Med Internet Res*, vol. 16, no. 12, p. e251, Dec 2014, doi:

10.2196/jmir.3240.

[21] A. Baroffio, M. R. Nendaz, A. Perrier, C. Layat, B. Vermeulen, and N. V. Vu, "Effect of teaching context and tutor workshop on tutorial skills," (in eng), *Med Teach*, vol. 28, no. 4, pp. e112-9, Jun 2006, doi: 10.1080/01421590600726961.

[22] A. Baroffio, M. R. Nendaz, A. Perrier, and N. V. Vu, "Tutor training, evaluation criteria and teaching environment influence students' ratings of tutor feedback in problem-based learning," (in eng), *Adv Health Sci Educ Theory Pract*, vol. 12, no. 4, pp. 427-39, Nov 2007, doi: 10.1007/s10459-006-9008-4.

[23] S. A. Azer, "Interactions between students and tutor in problem-based learning: the significance of deep learning," (in eng), *Kaohsiung J Med Sci*, vol. 25, no. 5, pp. 240-9, May 2009, doi: 10.1016/S1607-551X(09)70068-3.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix1.docx](#)