

Problem-based learning (PBL) and its limitations

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ABSTRACT

Problem based learning (PBL) helps to achieve critical thinking, promotes leadership qualities and managerial skills among students. This technique has already been a proven success in majority of the developed countries. Universities such as Maastricht have a pure PBL that involves no conventional lectures, other Universities like McMaster developed a PBL curriculum with few lectures, whereas Universities like Harvard Medical School implemented a hybrid PBL. lecturer in PBL spent more time with students in comparison with the conventional teaching method. Literature shows that students enjoy PBL more than the conventional model and feel PBL are more informative. Preceptors plays a key role in perceptions of PBL. Implementing PBL immediately in to the curriculum may not be easy with current traditional teaching dental schools, but PBL can be developed as horizontal hybrid so preserving the traditional teaching methods with preclinical/clinical structure and limiting the PBL component to the first two years.

Keywords: curriculum, hybrid PBL, Problem-based learning,

World Health Organization in 1994 recommended that dental education should be problem based, socially and culturally relevant, and community-oriented with that recommendations, among many other factors such as changed patterns in oral health, application of molecular and genetic research to dentistry, and an increasing rationalization of health management, prompted significant curriculum re-evaluation in dental education. Many dental schools around the world responded to set about constructing new curricula that were more responsive to student learning and more sensitive to evaluation mechanisms, those new curricula moved to be more contemporary student-centered approach, with flexible methods of teaching and learning that enabled

development of dental clinical skills enhanced by self-assessment and criterion referencing.¹

Usually conventional approach to dental education is teacher centered² with limited interaction between teacher & student. Each discipline is taught separately with minimal integration between them. Examinations are focused on detailed recollection of facts, with little requirement of application of knowledge.³

Problem-based learning (PBL) is a student-centered pedagogy in which students learn about a subject through the experience of solving an open-ended problem, they learn both thinking strategies and domain knowledge. The PBL originated from the medical school of thought and is now used in other schools of thought too & developed at the

McMaster University Medical School in Canada in 1960s now spread around the world. The basic goals of PBL are to help students develop flexible knowledge, effective problem-solving skills, self-directed learning, effective collaboration skills and intrinsic motivation.⁴

PBL is one of the novel techniques successfully implanted in majority of the health schools and colleges in developed countries. It can be defined as a learning method, a unique approach which uses real practice situation problems as a starting point working, as a stimulus or trigger for the acquisition and integration of new knowledge. A more accurate title has been suggested like "Student-centered, problem based, inquiry-based, integrated, collaborative, reiterative, learning". PBL has been proved to be a success that helps in the critical thinking ability, leadership, English speaking qualities, self-directed learning, teamwork, management skills, collaborative learning, professional and interpersonal skills and others.⁵

This concise overview is to highlight the need of PBL for teaching and learning within the dental curriculum which still has not gained much attention in dental education in many countries.

Basic rules for PBL groups.^{5,6}

Problem-Based-Learning: The "main instructions"

- A. The problem should come first
- B. The learning program should be student-centered
- C. Within a small group context

A successful PBL program requires that all three of these features are present. Remove any one, and the program fails!

1. Attendance and punctuality of the students are must.
2. Students can use the wall-charts/boards to study a case.
3. Thinking aloud in the group.

4. Should not skip steps in the PBL process.
5. Must evaluate its process on a regular basis.
6. Should not expect your facilitator to provide all details materials that related to the problem.

How to conduct & basic requirements of PBL.

5,7-19

A Facilitator or coordinator

The teacher should be a facilitator for PBL session. The task of the coordinator in a problem based tutorial group should be to facilitate the learning of students rather than to teaching.

The facilitator can and should change the flow of the discussion so group is focused, don't loss the track of the problem. also make the student's thoughts and encourage students to become self-reliant to gain information.

B PBL group:

PBL group should have 5 or 9 individuals entrusted to work symbiotically and cooperatively in a self-directed way on a delineated learning need. Which should be led by a group leader/ chairperson supported by a scribe/secretary. The group leader/chairperson makes crucial decisions if the team is unable to reach a consensus or horizontal teams in which crucial decisions are made by majority vote or can seek help from Facilitator or coordinator.

A Design of Trigger:

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knowledge.

- b Elaboration
- c Relevant context
- d Integration of knowledge
- e Self-directed learning
- f Interest in the subject matter
- g Faculty objectives

Triggers should stimulate the student's interest in resolving the problem scenarios presented to them So, Designing of PBL triggers/problems or task is very critical as poorly designed trigger will not cover the learning needs and the student's discussion may go out of control.

PBL triggers are integrated but the material is not taught in the same tutorials or by the teachers.

Triggers can be classified into three categories:

- a. Open type trigger: students knows the subject and topic are covered in PBL session.
- b. Single blind type trigger: students knows the subject but the topic discussed is not known.
- c. Double blind type trigger: students remains unknown for the subject and the topic of PBL session.

D PBL Sessions:

It should be done in two sessions. Each session to be of 1-2 hrs. Depending scope of the subject or case and for clinical subjects should not be less than 2 hours per session.

Session I should include:

- a Introduction
 - b Clarification of terms
 - c Brainstorming
 - d Learning outcomes
 - e Debriefing Session I
- a Introduction: facilitator should advise to choose the chairperson of the group for the

session. Taken care that everyone get chance to be a chairperson and experience the challenge of leading a group the skills developed from chairing a group at this stage in education can be extremely useful.

b Clarification of terms: Psychometric analysis done by Davis determine strategies and step for acquiring better comprehension skills, and he mentioned nine potential component skills of comprehension word meanings, word meanings in context, follow passage organization, main thought, answers specific text-based questions, text-based questions with paraphrase, draw inferences about content, literary devices, author's purpose, this first step is to agree on the meaning of the various words and terms and on the situation described in the problem/ trigger, helps to know knowledge possessed by the group members or it can retrieved from a dictionary.

c Brainstorming or generation of hypotheses: this stage will help in activating existing knowledge and to understand the phenomenon also promotes reasoning skills to create an explanation or hypothesis. This involves active discussion and exchange of knowledge and information here the facilitator should see that all members of the group feel free and to express themselves without any restraint. The chairperson will lead the discussion with functional and non-functional questions related to the trigger. The session to be actively assisted by the scribe/ secretary to record all generated hypothesis during the process.

brainstorming session should be followed after creating certain facts for the research to achieve the best conclusion as, student may come up with a variety of hypotheses during the session, this process may ventilate innovative practices and critical thinking ability of the students.

d) Learning outcomes or Learning needs: students should not be exposed to the learning needs, but they are supposed to transform all the generated hypothesis into learning needs as desired by the syllabus or subject.

e Debriefing Session I: at the end of the session the facilitator must address the students about their outcome with compliments and encouraging remarks so as to infuse the habit of critical thinking and problem solving.

Session II should include:

- a Review of trigger
- b Debriefing II
- c Evaluation

a Review of trigger: Students are allowed to go for self- directed learning using academic resources and to meet again for session II of PBL pedagogy students by now shall be equipped with newly acquired knowledge, the group to discuss the case which includes an explanation of the central concepts and mechanisms, analysis of the material and evaluation of its validity and importance. This process will develop a democratic attitude among students and will also develop the decision making by consensus. The facilitator should allow the students to lead, may help students where they lack information, but facilitator should be cautious in moving the team to their view point but taking into cognizance the pathway of the discussion.

b Debriefing II: after chairman announces the closure of the session now, facilitator should take charge and summarize the events in a constructive manner, this briefing should be highly motivating, especially in communication and presentation skills. Students should also give their viewpoints in respect of their own performance

c Evaluation: Das et al in 1998 suggested the

evaluation of students based on the following parameters using a Likert scale.

- a Responsibility
- b Information processing
- c Communication
- d Critical analysis
- e Self-awareness.

Discussion: Malmö Dental School was reopened in 1990 with a completely revised dental education curriculum employing PBL pedagogy. This development stands as a significant milestone in dental education, after that time there has been increasing interest in PBL-based dental curriculum development worldwide. The students in each PBL group are expected to identify problems or scenarios in a case-based format, generate hypotheses, and finally test their ideas after acquiring sufficient knowledge about the problem. At the end of each course, the tutor assesses each student on a variety of abilities along with a grade (honors/pass/fail). The assessment typically involves the students' knowledge acquisition, problem-solving with critical thinking, developing personal and interpersonal skills. The tutors or facilitator play a major role in the success of the PBL curriculum by facilitating student discussions and by encouraging self-directed learning. Evidence to date has supported that PBL has a positive effect on critical thinking, problem-solving skills, lifelong self-directed learning in medical and dental students.^{20,21}

Among a range of other reasons to convert to a PBL curriculum we might select: Traditional curricula tend to be more directed towards memorizing the facts and gaining technical skills without sufficient concern for understanding or clinical reasoning. Dense-packed traditional curricula allowing insufficient time for reflection and self-directed learning. Traditional curricula

fail to emphasize student responsibility for learning rather the focus is on faculty responsibility to teach the students.^{6,22}

Currently, some aspects of PBL are include in Dental schools of Europe (Sweden, The Netherlands, Norway, and the United Kingdom); Asia (Hong Kong, Singapore, and Thailand); Australia and New Zealand; and the United States and Canada.⁶ Recently, some dental schools in Saudi Arabia have proposed to use new curriculum that are based on a student-centered (PBL), than teacher centered approach.³¹

Why not all schools have PBL in their curriculum, what are the possible problems in implementing it?

Untrained facilitators in PBL, tutor or teacher tend to burn out after introductory phase and then opt out, resistance from teachers to adopt a newer method of teaching.^{23,24}

More manpower needs for PBL a cost factor.²⁵ Time limitations which makes dental schools to employ more convenient ways of teaching, rather than a revolutionized one.²⁶

Not much convincing evidence in support of PBL for developing the clinical hand skills of dental students. There are differences in required skills between dental and medical students which make the focus of dental education quite different from that of medical education, the feasibility of applying the findings of medical education studies, including those evaluating the effectiveness of PBL to dental education may be limited.²⁷

The dental education dramatically varies among different institutions in China. A standard criterion for dental education across the nation do not exist. The traditional education follows a teacher-oriented pattern, which places great emphasis' on disseminating actual knowledge, where students

passively receive traditional education methods have been used for many years and almost constitute the whole educational experience of them. The dental education in China are totally different from that in other countries, such as the United States.²⁶

India has a vast historical background in imparting knowledge. Ancient history shows that Sushruta, the great surgeon of ancient India, taught dentistry at Kashi, in 600 B.C. In India PBL has made entry into several medical schools of repute, they are experimenting PBL as an adjunct to traditional teaching, although it has not been widely implemented, it needs certain structural changes in the dental education system both at the undergraduate & postgraduate level.

Postgraduate level which provides the pool of educators and teachers for undergraduate dental education.

The dental faculties play an important role in shaping the dental education in India. After completion of master's degree in their specialty, they lack intensive research training and also there is no formal teachers training when they join as teacher in dental colleges. In this era of information technology where good scientific data are available online, there is a need to improve the teaching methods for imparting quality education.

The undergraduate curriculum is divided into pre-clinical and clinical phases, with limited integration. Students learn theory and concepts through class room settings with didactic lectures. the practical knowledge is through the patient work in various clinical specialties for undergraduate curriculum. The clinical seminars, case presentations or treatment planning concepts are not obligatory hence developmental of analytical and logical skills are not given importance in undergraduate training program. In

the postgraduate study, importance is given for journal clubs, seminar presentation, library dissertations which helps the students to organize their knowledge to improve the clinical skills. Most of the dental colleges have 100 undergraduate students intake every year and about 3-6 post graduate (PG) students in each department. So, implementing PBL in undergraduate level will be unwieldy because of the manpower, but PBL can be incorporated in the postgraduate curriculum where the intake of students is very few.

Facilitator plays a major role in success of PBL & they should have sufficient training, knowledge, problem solving skills, sensitive to the dynamics and differing feelings of the group as it may have mixed learning community. PBL has both advantages and disadvantages. Advantages may be like greater independence, self-responsibility, teamwork, flexibility, student contact, less memorization, better theory and clinical application, and have no pressure with respect to grades. Disadvantages of PBL may be uncertainty about the right learning needs, depth of knowledge reached and choosing the right literature, time-consuming, uncommitted study groups, too much responsibility, and concern about picking the wrong learning needs given that facilitators do not direct. Many systematic reviews of PBL in dental education have reported that the effectiveness of PBL are limited, hundreds of studies involving dental PBL are available, it is difficult to quantify its educational benefit, due in part to variation in PBL implementation.^{3,28,29-33}

CONCLUSION

Problem Based Learning (PBL) was developed more than 40 years ago in reaction to the problems and limitations of traditional teaching approaches.

Preceptors plays key role in perceptions of PBL. Implementing PBL immediately in to the curriculum may not be as easy as in few countries, as it can be resistance from teachers to adopt a newer method of teaching or probably he/she would be already overloaded with present duties or doing the traditional teaching from decades, governing body of the dental schools may not accept the cost factor of high manpower. It can be of a “hybrid” essentially preserving the traditional “early clinical/clinical” structure and limiting the PBL component to the first two years. A gradual implement of hybrid curriculum with traditional teaching & PBL can be expected in near future. There is need of problem-based learning, evidence-based curriculum, and competence-based education curricula with the application of the latest development and focus of development of the new approach to dental education.^{8,30-33}

REFERENCE

1. Gerzina TM, Worthington R, Byrne S, McMahon C. Student use and Perceptions of different learning aids in a problem- based learning (PBL) dentistry course. J Dent Educ. 2003;67(6):641–53.
2. Wood DF. Problem-based learning. BMJ. 2008;336(7651):971.
3. Peedikayil ,Chalil. Practice of Problem Based Learning among Dental Faculty in India. J Contemp Med Edu. 2015;3:(3)101-05.
4. Hmelo-Silver CE."Problem-Based Learning: What and How Do Students Learn?". Educational Psychology Review. 2004;16(3):235–66.
5. Ansari T M,RahmanS, Badgujar B V, Sami F,Abdullah S F. Problem Based Learning (PBL): A Novel and Effective Tool of Teaching and Learning Indian J Pharm Educ

- 2015;49(4) 258-66.
6. Fincham AG, Shuler CF The changing face of dental education: the impact of PBL J Dent Educ. 2001;65(5):406-21.
7. Cindy E, Hmelo-Silver chmelosi, Howard Barrows S. Goals and strategies of a problembased learning facilitator. IJPBL 2006;1(1): 21-39.
8. Barrows HS, Tamlyn RM. Problem-based learning: Rationale and definition. In: Problem based learning: an approach to medical education. 1st Edition New York; Springer Publishing Company 1980; 1-18.
9. Dolmans DHJM, Snellen-Balendong H, Wolfhagen HAP, van der Vleuten CPM. Seven principles of effective design for a problem-based curriculum. Med Teach 1997;19(3):185–89.
10. Guide to problem-based learning - University of York. Available online from https://www.york.ac.uk/media/law/document/s/pbl_guide.pdf.
11. Dejan Bokonjic, Mladen Mimica, Nurka Pranjic, Vanja Filipovic, Sladana Cosovic, Hans Martin Bosse, et al. Problem based learning. In. Manual of teaching and learning in medicine. Steiner T. and Sonntag HG., D. Bokonjic Editors. Available online from http://www.bhmed-emanual.org/chapter_7_problem_based_learning.
12. Willie Yip. Students' perceptions of the technological supports for problem-based learning. Education and Information Technologies 2002; 7(4): 303–12.
13. Ed. Teena J. Clouston, Lyn Westcott, Steven Whitcombe W., Jill Riley, Ruth Matheson. Problem based learning in health and social care. In: Promoting creative thinking and innovative practice through the use of problem-based learning Wiley Blackwell. 2010. 125-38.
14. Larmer J, Mergendoller J R. Seven essentials for project-based learning giving students meaningful work. 2010; 68(1): 34-37.
15. Michael Peterson. Skills to enhance problem-based learning. Med Educ Online; 1997. 2,3. Available from: URL <http://www.utmb.edu/meo/>
16. Kinnunen Palvi, Malmi Lauri. Problems in problem-based learning – experiences, analysis and lessons learned on an introductory programming course. Informatics in Education 2005; 4(2): 193–14.
17. Donovan G, Cluer J. 100 Lessons from self-managed work teams. Perth, Australia: SMWTGN; 1994.
18. Michael Peterson. Skills to enhance problem-based learning. Med Educ Online; 1997. 2,3. Available from: URL <http://www.utmb.edu/meo/>
19. Das M, Mpofu D, Dunn E, Lanphear JH. Self and tutor evaluations in problem based learning tutorials: is there a relationship? Medical education 1998; 32(4): 411-18.
20. Allareddy V, Havens AM, Howell TH, Karimbux NY. Evaluation of a new assessment tool in problem-based learning tutorials in dental education. J Dent Educ. 2011;75(5):66571.
21. Rohlin M, Petersson K, Svensater G. The Malmö model: a problem-based learning curriculum in undergraduate dental education. Europ J Dent Educ 1998;2:103-14.
22. Norman GR, Schmidt HG. The psychological basis of problem-based learning: a review of the evidence. Acad Med 1992;67:557-65.
23. Colliver JA, Markwell SJ: Research on problem based learning: the need for critical

- analysis of methods and findings. *Med Edu* 2007;41:533-35.
24. Eagle CJ, Harasym PH, Mandin H: Effects of tutors with case expertise on problem-based learning issues. *Acad Med* 1992;67(7):465-69.
 25. Distlehorst LH, Dawson E, Robbs RS, Barrows HS: Problem-based learning outcomes: the glass half-full. *Acad Med* 2005;80(3):294-99.
 26. Huang B, Zheng L, Chunjie Li, Haiyang Yu: Effectiveness of Problem-Based Learning in Chinese Dental Education: A Meta-Analysis *J Dent Educ*. 2012;21(4): 377-87.
 27. Bassir H S, Sadr-Eshkevari P, Amirikhorheh S, Karimbux Y. Problem-Based Learning in Dental Education: A Systematic Review of the Literature *J Dent Educ* 2014;78(1): 98108.
 28. Susarla SM, Medina-Martinez N, Howell TH, Karimbux NY. Problem-based learning: effects on standard outcomes. *J Dent Educ* 2003;67(9):1003–10.
 29. Viridi, S M Quality Considerations in Dental Education in India *J Dent Educ*. 2012; 76(3):27276
 30. Depaola DP. The revitalization of U.S. dental education. *J Dent Educ* 2008;72(2):28–42.
 31. Alrahlah A. How effective the problem-based learning (PBL) in dental education. A critical review *Saudi Dent J*. 2016; 28(4): 155–161.
 32. Azer SA, Azer D. Group interaction in problem-based learning tutorials: a systematic review. *Eur J Dent Educ* 2015;19(4):194–208
 33. Amin M, Zulla R, Gisele Gaudet-Amigo, Patterson S, Murphy N, Ross S. Dental Students' Perceptions of Learning Value in PBL Groups with Medical and Dental Students Together versus Dental Students Alone. *J Dent Educ*. 2017;81 (1): 65-74.