

Motivating Factors and Effectiveness of Problem-based Learning in Dental Education

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Abstract

Problem-based learning (PBL) is a learning approach that involves the use of interdisciplinary problems to trigger learning. The process of PBL encouraged students to be familiar with methods of search for knowledge creating new sets of learning needs which may not have been covered in the traditional teaching and learning (T&L). The result of review on available researches that compares PBL with traditional methods of medical education showed the superiority of PBL approach. However, in another critical review of published articles on PBL revealed no convincing evidence that it improves knowledge acquisition and clinical performance over traditional methods of T&L. Thus this study was carried to assess motivating factors in PBL and its effectiveness in creating student centred learning for clinical dental undergraduates. PBL triggers were introduced during the first of the three, two hours sessions for ninety one clinical students of year 3, 4 and 5 of the Faculty of Dentistry, Universiti Teknologi MARA, Malaysia. Sixteen questions were given to students during the third session and motivating factors and effectiveness of PBL were analysed. The results showed that majority of students perceived solving problems together was interesting and stimulate learning. Sharing of new information broaden their learning approach, critical thinking, creativity and communication skills. PBL is effective in internalising deep learning approach for dental undergraduates and encourage them towards active, interesting team participation in knowledge gain. PBL also motivated students to seek scientific knowledge independently towards achieving the desired learning outcomes. Knowledgeable, constructive and dedicated facilitators made the T&L experience interesting, stimulating and interactive for the students.

Keywords: PBL, Motivating Factors, Effective SCL (Student-centred learning)

INTRODUCTION

PBL is a learning approach that involves the use of interdisciplinary problems to trigger learning. A review paper by Savery 2006 [1] defined PBL as an “instructional learner-centered approach that empowers students to conduct research, integrate theory and practice and apply knowledge and skills to develop a viable solution to a defined problem. The process of PBL encouraged them to be familiar with methods of search for knowledge, creating new sets of learning needs which may not have been covered in the traditional T&L. PBL was officially adopted as pedagogical approach at McMaster

University, a Canadian Medical School in 1968. A number of others, University of Delaware and the Samford University in Alabama use PBL in their curriculum. Winning & Townsend 2007 [2] reported that eleven Australian Dental Schools have introduced PBL approaches to their programmes for over a decade. Though the nature of innovation varied from school to school, generally students enjoyed PBL programmes more than conventional T&L methods. There was some evidence of an improvement in clinical and diagnostic reasoning ability associated with PBL curricula. Well-planned hybrid PBL programmes with matching methods of assessment, can foster development of the types of knowledge, skills and attributes that oral health professional will need in the future. PBL involves small groups of students discussing trigger materials, determining what they need to study and meeting again to share the result of knowledge they searched. Approaches to PBL involved identifying the facts in the scenario, generate ideas about the scenario and identifying learning outcomes. The process helped students to fill the gaps in their own knowledge base, use or discard the new knowledge they acquired, thus generating new set of learning needs, integrating variety of disciplines and negotiating differences. Facilitators observed the group interactions, guided and gave feedback on work process. In an overview of PBL, self and peer assessment complete PBL processes involving knowledge, critical thinking, communication skills and working in a group. The reflection of learning outcomes and debriefing on the learning process form group dynamics which are essential components of PBL.

The use of real-life scenario in dentistry, taught students actual problems in patient management, internalised content, developed and sharpened their thinking skills. In PBL, students were given more responsibilities for their education and they became increasingly independent of their teachers. The result of review on available researches from 1970 through 1992 that compares PBL with traditional methods of medical education showed the superiority of PBL approach. In the implementation of PBL for dental hygiene program, the positive outcomes was shown in the intended areas of problem solving, critical thinking, team skills and personal growth (Moore, 2007 [3]). There was evidence that PBL is popular with students, associated with better clinical and problem-solving skills, that it promotes lifelong learning and does not sacrifice important areas of knowledge (Christopher E.C. 2006[4]). However the review of the literature on the effectiveness of PBL Curricula: research and theory by Colliver 2000 [5] revealed no convincing evidence that PBL improves knowledge base and clinical performance. He however related that the magnitude of improvement or benefits would be expected given the resources required for a PBL curriculum. The results also showed that majority of students perceived that solving problems together was most beneficial, interesting, and interactive. Sharing of new information broaden their learning approach, critical thinking, creativity and communication skills.

Polzois et al. 2010 [6] also did a systematic literature review of PBL in academic health education. They concluded that at the level of randomised-controlled trials and whole curricula comparative studies, no clear difference was observed between PBL and conventional teaching. Benefits of PBL were clear in comparative studies of single PBL intervention in a traditional curriculum. Lim & Chen 1999 [7] reported a pilot project on the introduction of PBL to dental curriculum. The initial feedback from students

indicated a positive response in terms of cognitive, affective and psychomotor skills. However, problems that needed to be resolved include choice of outcome assessment measures to evaluate the effectiveness of PBL as a mode of learning in dental education. Challenges of PBL in dental education were observed which include overcoming of resistance by educators and implementation issues. These could only be overcome by obtaining support from top management and training of the facilitators on PBL (Zubaidah et al. 2005[8]).

AIM OF STUDY

To assess motivating factors in PBL and its effectiveness in creating student-centered learning for clinical dental undergraduates.

METHODOLOGY

PBL triggers were introduced in the first of the three, two hours sessions for ninety one year 3, 4 and 5 dental students of the Faculty of Dentistry, Universiti Teknologi MARA, Malaysia. Students were divided into a group of ten facilitated by one facilitator staff for two earlier session and a joint presentation during the third session. The students read through the triggers/scenario, discussed the case, defined problems, identify learning issues and organised the scope of learning that they want to pursue. Results of knowledge search were presented and discussed with full participation from every member of the group. Facilitators guided the discussion, observed the group interaction and provided feedback and individual assessment of students. These were the learning process and group dynamics adopted as essential component of PBL. At the end of the sessions, all students were asked to complete self-administered questionnaires. A total of sixteen questions were organized into six (6) questions (Q) on perceived motivating factors and seven (7) questions on perceived effectiveness of PBL. All responses and scores were entered and analysed in the Statistical Package for Social Science (SPSS version 15).

RESULTS

Ninety one (91) year 3, 4 and 5 dental students were involved in this study. Students answered 6 questions on perceived motivating factors of PBL. The frequency distributions of the PBL motivating factors and effectiveness were skewed to the positive. Majority (99%; n=90) felt that PBL made them more responsible of their own and group learning management. PBL was interesting (92%) and students were motivated by active learning (86%) student-centred (93%) and doing problem solving in a group helps them learn better (98%). However 57% of students have difficulty in getting involved in group discussion (n=52).

Table 1: Students' perception on motivating factors of PBL sessions

Q No.	I perceived:	Agree		Disagree/ No respond	
1	PBL sessions made me more responsible for my own and my group learning management.	90	99	1	1
2	PBL is more interesting way of learning than conventional lectures/ tutorials.	84	92	7	8
3	To prefer active learning methods in PBL than passive learning method.	78	86	13	14
4	To prefer student-centered learning (SCL)	85	93	6	7
5	To have difficulties in getting involved in the group discussion	52	57	39	43
6	Working through problems as a group helps me to learn.	89	98	2	2

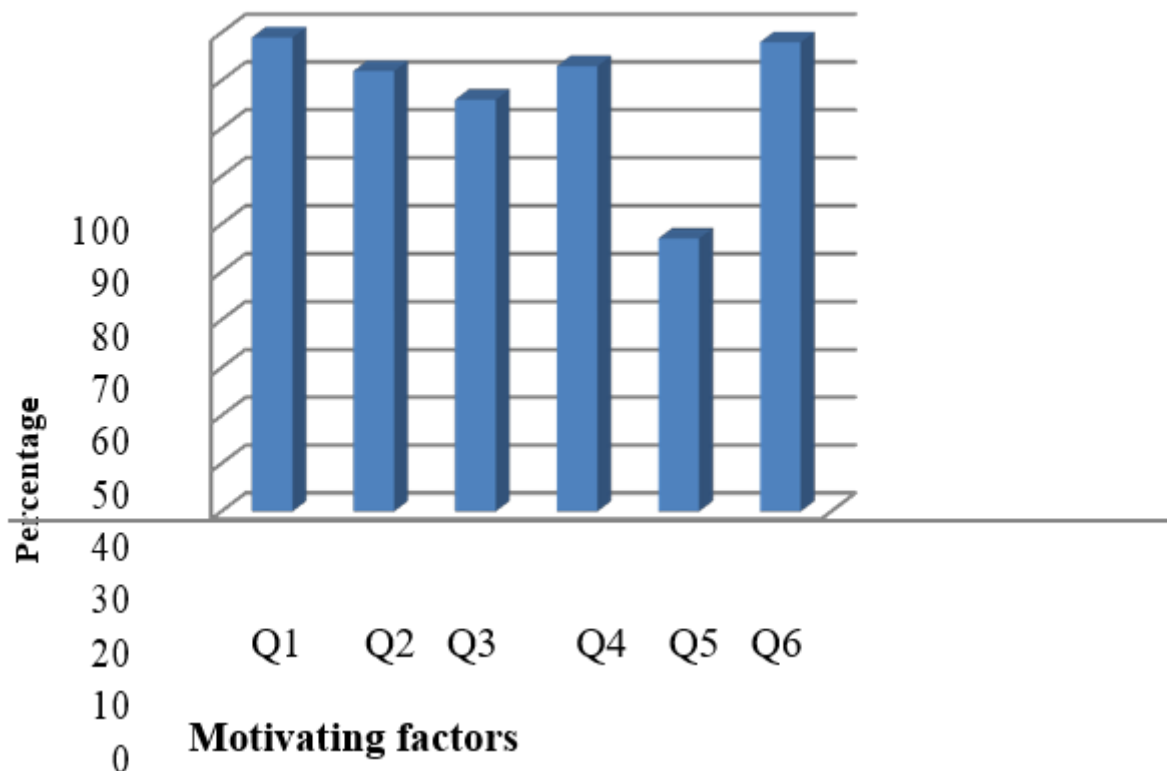
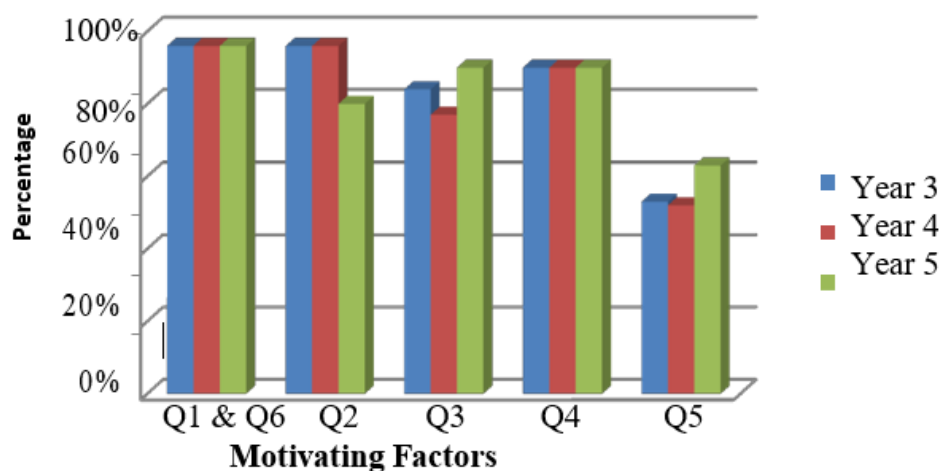
**Fig 1: Perception on motivation factors**

Table 2: Comparing motivating factors for Year 3, 4, 5 students

Students	Improve learning and problem solving (Q1 & Q6)	Interesting (Q2)	Active learning (Q3)	Improve SCL(Q4)	Difficulties getting involved in gp discussion(Q5)
Year 3	29 : 96%	29 : 96%	26 : 84%	27 : 90%	16 : 53%
Year 4	30 : 96%	30 : 96%	24 : 77%	28 : 90%	16 : 52%
Year 5	30 : 96%	24 : 80%	27 : 90%	29 : 96%	19 : 63%

Differences between year 3, 4 and 5 were not significant for questions 1, 2, 4 and 6, however more than half of students perceived to have difficulties in getting involved in the group discussion (52-63)%. Somehow the year 5 perceived that it was less interesting and less preference for active learning for year 3 and 4 (Table 2).

**Fig 2: Comparing Motivating Factors****Table 3: Students' perception on effectiveness of PBL sessions:**

Q No.	The PBL sessions helped me to:	Agree		Disagree/ No respond	
		n	%	n	%
1	understand concept and process of PBL	88	97	2	2
2	integrate knowledge on thinking and communication.	89	98	2	2
3	appreciate deep learning	88	97	3	3
4	improve critical thinking	89	98	2	2
5	improve communication skill	89	98	2	2
6	appreciate teamwork	84	91	7	9
7	learn independently	86	95	5	5

Students answered seven questions pertaining to effectiveness of PBL. Majority (98%) felt that the sessions have helped them to understand concept and process of PBL (Q1) integrate knowledge (Q2) and improve their critical thinking (Q4). Most of them felt that they appreciated deep learning (97%) and taught them on independent learning (95%) However about 9% felt that PBL did not improve teamwork (Table 3 & 4). Comparing between years showed year 5 scoring 100% for teamwork. **Table 4:**

Comparison between years 3, 4, 5 on effectiveness of PBL

Students	Understand concept and process of PBL (Q1) Integrate knowledge (Q2) Improve critical thinking (Q4)	Deep learning (Q3)	Improve communication (Q5)	Team work (Q6)
Yr 3	29 : 96%	29 : 96%	29 : 96%	28 : 93%
Yr 4	30 : 96%	29 : 93%	29 : 93%	28 : 90%
Yr 5	29 : 96%	29 : 96%	28 : 93%	30 : 100%

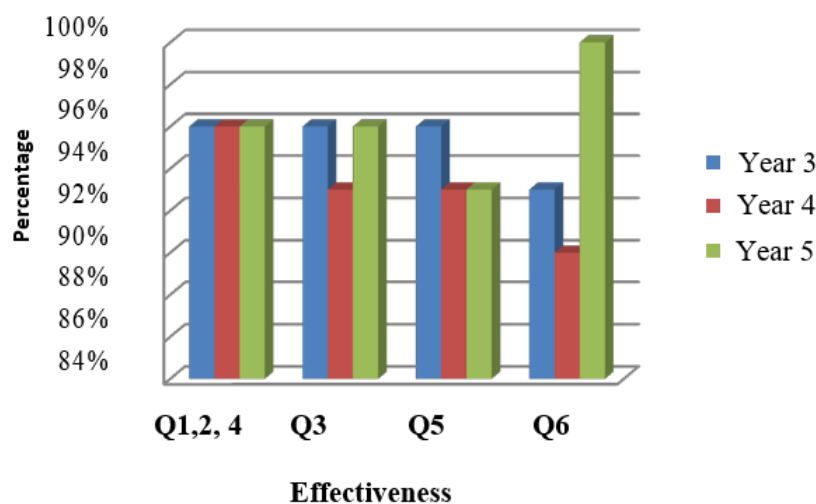


Fig3: Comparing effectiveness

DISCUSSION

PBL has been adapted at the Faculty of Dentistry, Universiti Teknologi MARA as a teaching methodology to inculcate self-learning, improve critical thinking, team work and integrate knowledge for comprehensive patient management. Together with blended learning which is the integration of classroom face to face with on-line learning, students seek knowledge independently on their own or as a team to solve problems given in the triggers or scenarios. The information and communication technology (ICT) components offered added value to the traditional teaching in knowledge attainment. The motivating factors and effectiveness of PBL were discussed as below:

1. Motivating Factors - improve learning and problem solving, interesting; encourage active learning and self-motivation

Development of professional attributes is heavily emphasised throughout the five years of dental curriculum. The response percentage for all factors in this study was above 85% and the frequency distribution of the PBL experience and development of professional attributes which was skewed to the positive was also in agreement with work of Pau and Croucher 2003 [9]. Majority of students at the time of study (86-98%) thought PBL motivated them to learn interesting and solving the triggers and scenarios help them learn better. In a study by Chang et al. 1995 [10] on the role of PBL in undergraduate surgical education found that PBL improved student motivation and they enjoyed the educational experience. At the University of Limburg, the Netherlands, students generated learning issues not expected by the faculty and half of the issues were judged relevant to the course content during PBL sessions. Thus PBL seemed to permit students to adapt learning activities to their own need and interests (Dolmans et al, 1993[11]). The generation of new learning issues can assist the faculty in improving the specific learning outcomes in particular and the dental curriculum as a whole. Study by Regan in 2003 [12], highlighted a wide range of motivational factors and the importance of lectures in motivating students towards self-directed learning. Students need specific guidance and feedback which, in our PBL, provided for by the same facilitators who were present in all the three PBL sessions.

2. Effectiveness - understand concept and process of PBL, integrate knowledge, team work, improve critical thinking and communication and encourage deep learning.

They were significant benefits seen during the three sessions of PBL carried out. These benefits were also acknowledged in a work done by Wetherell & Mullin in 1994 [13], which described the significant features of PBL in the teaching of oral diagnosis which were setting goals, reflections, self-assessment and relating clinical practice to problem solving. The superiority of PBL was confirmed by Vernon and Blake, 1993 [14]. The research done in 1970 to 1992 concluded that PBL was found to be significantly superior to traditional methods of medical education with respect to students' programme evaluation. Lin et al., 2010 [15] studied the learning effectiveness of peer-tutored PBL and conventional teaching of nursing ethics in Taiwan. They found that there were significant differences in satisfaction were noted with self-motivated learning and critical thinking between the two groups of their study. Similar study was conducted by Beachery in 2007 [16] in respiratory education and he concluded that the students who undergone PBL were more satisfied and rated their program quality higher.

Kieser et al. 2006 [17] compared dental students with dental technology students in their approach to learning. It was found out those dental students who had well developed understanding of oral biology at the start of the course adopted deep learning strategies well. 97% of our dental students agreed that PBL helped them towards deep learning which is thought to be more suitable to continuing medical education. This collaborative learning encourages the constructing of knowledge compared to pedagogies

that focus on content, memorization of facts and passing of examinations. It also improves the retention of knowledge through understanding instead of memorising. By using media type such as video presentation, it was found to be more effective in analyzing critical thinking (Raychav et al. 2015[18]). Year 5 students who have been exposed more to PBL seemed to have high percentage of agreement for all the questions, the highest being that they appreciate teamwork (100%). This was indicated through the comradeship that they have developed throughout the five years of their study. The limitation to this study was that there was no biographical data of students taken as they felt that asking for data would have made the questionnaires and results less anonymous

A review paper by Wosinki et al. in 2018 [19] concluded that tutors/facilitators should be trained to effectively guide the team work of students along the PBL process in order for them to achieve its goal and students should be securely introduced to PBL and experience the development of their clinical reasoning through PBL. Future research should focus on the strategies to succeed with PBL. However study carried out by Abdel Karim et al., 2018 [20] on PBL for medical and dental education concluded that PBL should not be used as the sole method of instruction and that student needed a solid foundation in the subject prior to engaging in PBL.

CONCLUSION

Clinical dental undergraduates perceived being motivated by the PBL they went through in each semester of their five years undergraduate study. It was effective in internalizing deep learning approach for them and encouraged them towards active, interesting team participation. PBL also motivated them to seek scientific knowledge independently towards achieving the desired learning outcomes. Majority agreed that PBL is effective in making them understand concept and process of PBL to integrate knowledge into clinical practice. The development and improvement in professional attributes which were heavily emphasised throughout the five years of dental curriculum would be very useful and valuable in their future career. Knowledgeable, constructive and dedicated facilitators made the T&L experience interesting, stimulating and interactive for the students.

REFERENCES

- [1] Savery, JR. (2006). Overview of problem-based learning. *The Interdisciplinary Journal of problem-based learning*. Vol. 1 No.1:9-20.
- [2] Winning T. & Townsend G. (2007). Problem-based learning in dental education: What's the evidence for and against... and is it worth the effort? *Aust. Dent J.* Mar; 52(1):2-9.
- [3] Moore T.S. (2007). Implementation of problem-based learning in Baccalaureate dental hygiene programme. *J. Dent Educ.* 71(8): 1058-1069.
- [4] Christopher E.C. (2006). Problem-based learning: how do the outcomes compared with traditional teaching? *Br J Gen Pract.* 56(530):722-23.
- [5] Colliver JA. (2000). Effectiveness of problem-based learning curricula: research and theory. *Acad Med.* Mar; 75(3):259-66.

- [6] Polozois I, Claffey N, Mattheos N. (2010). Problem-based learning in academic health education. A systematic literature review. *Eur J Dent Educ.* 14(1):55-64.
- [7] Lim L.P & Chen A.Y.(1999). Challenges and relevance of PBL in dental education. *Eur J Dent Educ;*3(1):20-26.
- [8] Zubaidah HAR, MI Abu Hassan, Mohamed N, Azila NMA and Kardos TB. Challenges and rewards in establishing problem-based learning. Abstract in the 4th Asia-Pacific Conference on Problem-based Learning in the Health Sciences: PBL in a Changing Global Environment, pg 33, 22-25nd Sept. 2004 Manila, Philippines.
- [9] Pau AK, & Croucher R. (2003). The use of PBL to facilitate the development of professional attributes in second year dental students. *Eur J Den Educ.* Aug;7(3):123-9.
- [10] Chang G, Cook D, Maguire T, Yakimets WW, Warnock GL. (1995). Problem-based learning: its role in undergraduate surgical education. *Can J Surg.* Feb; 38(1):13-21.
- [11] Dolmans DH, Gijsselaers WH, Schimdt HG, van de Meer SB. (1993). Problem effectiveness in a course using problem-based learning. *Acad Med.* Mar;68(3):207-13.
- [12] Regan JA. (2003). Motivating students towards self-directed learning. *Nurse Educ Today.* Nov;23(8):593-9.
- [13] Wetherell J. & Mullins G. (1994). A problem-based approach to a course in oral diagnosis. *Aust. Dent J.* Jun; 39(3):190-2.
- [14] Vernon DT. & Blake RL. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Acad Med.* July;68(7):550-63.
- [15] Lin CF, Lu MS, Chung CC, Yang CM. (2010). A comparison of problem-based learning and conventional teaching in nursing ethics education. *Nurs Ethics.* May;17(3):372-82.
- [16] Beachery WD. (2007). A comparison of problem-based learning and traditional curricula in baccalaureate respiratory therapy education. *Respir Care;* 52(11):1497-506.
- [17] Kieser J, Herbison P, Waddell N, Kardos T, Innes P. (2006). Learning in Oral Biology: a comparison between deep and surface approaches. *N Z Dent J.,* Sept; 102(3): 64-8.
- [18] Reychay I, Warkentin M, McHaney R (2015), Exploring Effects of Media Type and Delivery Technology on Facilitating Critical Thinking Among College Students. *Journal of educational technology system.* Research Article <https://doi.org/10.1177/0047239515598506> .
- [19] Wosinski J, Belcher AE, Dürrenberger Y, Allin A, Stormacq C, Gerson L(2018). Facilitating problem-based learning among undergraduate nursing students: A qualitative systematic review. *Nurse education today.* Volume 60, January 2018, pages 67-74.
- [20] Ahmad Abdelkarim A, Schween D and Ford T (2018). Attitudes towards Problem-Based Learning of Faculty Members at 12 U.S. Medical and Dental Schools: A Comparative Study. *Journal of Dental Education* February 2018, 82 (2) 144-151; DOI: <https://doi.org/10.21815/JDE.018.019>

Acknowledgment: The authors wished to thank the Dean and the facilitators of PBL in the Department of Restorative Dentistry, Faculty of Dentistry, Universiti Teknologi MARA for their support in this dental education study.