

# Problem-based learning: Dental student's perception of their education environments at Qassim University

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## Abstract

**Aims:** The objectives of this study were to assess perceptions of the Saudi dental students of the problem-based learning (PBL) curriculum and to compare their perceptions among different sex and academic years. **Subjects and Methods:** Data was collected through a questionnaire-based survey at Qassim College of dentistry. The questionnaire consisted of 19 questions regarding the perception of PBL curriculum and was distributed to 240 students. The chi-square test was used for statistical analysis of the data. **Results:** Out of the 240 students recruited for this study, 146 returned a complete questionnaire (the response rate was 60.8%). The majority of the students perceived that PBL enhances the ability to speak in front of people (91.1%); improved the ability to find the information using the internet/library (81.5%); enhances the problem-solving skills (71.3%); increases the practice of cooperative and collaborative learning (69.2%); improves the decision-making skills (66.4%). Sixty-five percent ( $n = 96$ ) noted that some students dominate whereas others are passive during PBL discussion session. Statistically, significant differences were found in the following variables according to the academic year students assuming before responsibility for their own learning ( $P < 0.037$ ) and the role of facilitator in the process ( $P < 0.034$ ). Moreover, according to gender; there were statistically significant differences in the following variables, assuming responsibility for own learning ( $P < 0.003$ ); activating prior knowledge and learning to elaborate and organize their knowledge ( $P < 0.009$ ); enhancing the ability to find the information using the Internet/library ( $P < 0.014$ ); PBL is effective without having lecture of the same topic ( $P < 0.025$ ); helping in identifying the areas of weakness for improvement ( $P < 0.031$ ); student understanding the objectives of the PBL session better than the conventional way ( $P < 0.040$ ); and enhancing the ability to speak in front of people ( $P < 0.040$ ). **Conclusions:** Perceptions of Saudi dental students regarding their education environments at Qassim College of dentistry using PBL hybrid curriculum were more positive than negative. However, improvements are still required to provide students with stimulating favorable learning environment and to take the students recommendations into consideration.

**Key words:** Dental students, education, perception, problem-based learning

## INTRODUCTION

Problem-based learning (PBL) is an educational strategy in which a problem serves as the stimulus for active learning. The PBL approach depends on

students in the way that students recognize and define the problem and state learning issues that are essential to develop a complete understanding of the problem. This approach is based on small groups of students working together and collaborating with a faculty

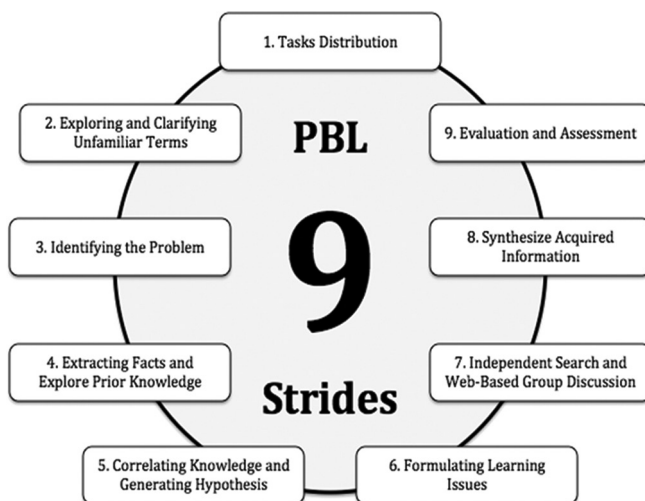
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member.<sup>[1]</sup> PBL is a powerful classroom process, which uses problems to incite students to identify and apply research concepts and relate collected information, work collaboratively, and communicate effectively. The main objective of any PBL is to enhance adult learning skills by engaging students through self-direction and problem-solving, thus helping students retain information.<sup>[2-4]</sup> PBL students were reported to have better problem-solving abilities and were better disposed towards research compared to traditional base students.<sup>[5]</sup> Furthermore, PBL students show significant improvements in preventative care and diagnostic performance in practice after graduation.<sup>[6,7]</sup> Effects of PBL methodology have been reported previously. For example, PBL has been reported to be effective at increasing the students' critical and interdisciplinary thinking, communication with patients, cooperation skill, problem-solving skill, and ability to work independently.<sup>[8-10]</sup> The College of Dentistry at Qassim University is among the few dental colleges in Saudi Arabia that introduced PBL as a very important part of study curriculum. The college follows a hybrid system, which is based on didactic lectures with PBL as self-directed learning strategies. A PBL session is typically conducted in steps, which are illustrated in Figure 1. Existing data revealed that undergraduate medical students in Saudi Arabia are satisfied with PBL curriculums because it is superior to the traditional system.<sup>[2,11,12]</sup> However, little is known about the perception of dental students based on their experience in relation to the implementation of this strategy. Therefore, an evaluation was performed to determine the perception of students based upon their experience regarding the implementation of this strategy as well as to compare their perceptions of different sex and academic years.



**Figure 1:** PBL strategy of College of Dentistry, Qassim University

We believe that the present study will help us to make recommendations that will form the basis of policies at the institutional level and ultimately by regulatory bodies.

## SUBJECTS AND METHODS

A cross-sectional study was conducted to assess the perception of the students regarding the PBL curriculum, which is implemented at the College of Dentistry, Qassim University. The study was carried out between December 2014 and April 2015. Ethical approval and informed consent for carrying out the present study was obtained by the ethical committee at Dental Research Centre (DRC), College of Dentistry, Qassim University. The sampling frame was taken from all undergraduate dental students who study at Qassim University during our research project and participated in this study. A convenience study sample was randomly selected from the sampling frame. A total of 240 dental students agreed to participate. The inclusion criterion for this study was any Qassim dental students who are Saudi citizens and want to participate on the day of the study. Those unwilling to fill in the questionnaire and gave incomplete answers to the questionnaire were excluded. The paper-based questionnaire used in the study was an anonymous self-administered pretested structured questionnaire that was developed and validated by Usmani *et al.*<sup>[13]</sup> The questionnaire was slightly modified to achieve the objectives of the study. Four questions were excluded after we conducted a pilot study and realized that the four questions were difficult to understand according to our student's level of English. The questionnaire consisted of 19 statements (close-ended questions) assessing the perception of the students regarding PBL curriculum using a 5-point Likert scale with a score of 1 = strongly disagree (SDA), 2 = disagree (DA), 3 = uncertain (UC), 4 = agree (A), 5 = strongly agree (SA) were distributed. We also asked the students three open questions at the end of the survey; we requested them to list two strengths, two weaknesses, and two suggestions to improve our PBL. All data were managed and statistically analyzed using the Statistical Package for the Social Sciences software version 14.0 (SPSS Inc., Chicago, IL, US). Absolute and percentage distributions were obtained for qualitative variables. Pearson's chi-square test was used for data analysis. The margin of error for interpretation of the statistical tests was set at  $P < 0.05$ .

## RESULTS

Out of the 240 students recruited for the study, 146 undergraduate dental students returned a complete

**Table 1: Precipitant demographic profile**

Variable	Categories	Number (%)
Gender	Male	66 (45.2)
	Female	80 (54.8)
Study year	First year	37 (25.3)
	Second year	21 (14.4)
	Third year	29 (19.9)
	Fourth year	29 (19.9)
	Fifth year	30 (20.5)

questionnaire (the response rate was 60.8%). Mean age was 22.2 years (SD  $\pm$  1.9), and female students constituted 54.8% of the sample. Details of other characteristics of the sample are presented in Table 1. A majority perceived that PBL enhances the ability to speak in front of people (91.1%); improves the ability to find the information using the internet/library (81.5%); enhances the problem-solving skills (71.3%); increases the practice of cooperative and collaborative learning (69.2%); improves the decision making skills (66.4%); helps in identifying the areas of weakness for improvement (53.5%), and helps to convert from passive to active life-long learner (53.4%) [Table 2]. Consequently, there were statistically significant differences according to the academic year and those concerning to students responsibility for their own learning ( $P = 0.037$ ) and the role of facilitator in the PBL process ( $P = 0.034$ ) [Table 1]. On the other hand, few students (16.4%) disagreed that PBL activates or enhances their prior knowledge. When responding to a statement on the disadvantages of PBL, the majority agreed that some students dominate while others are passive in the discussion (65.7%) [Table 2]. Nearly 39% agreed that the current PBL-lecture hybrid system is better than the entirely lecture-based curriculum. However, more than half of the students disagreed that PBL is effective without having a lecture on the same topic [Table 2]. Table 3 presents a comparison of the students' responses according to gender. There were statistically significant differences between male and female students in many variables, including assuming responsibility for own learning ( $P < 0.003$ ); activating prior knowledge and learning to elaborate and organize their knowledge ( $P < 0.009$ ); enhancing the ability to find the information using the internet/library ( $P < 0.014$ ); PBL is effective without having lecture of the same topic ( $P < 0.025$ ); helping in identifying the areas of weakness for improvement ( $P < 0.031$ ); student understanding the objectives of the PBL session better than the conventional way ( $P < 0.040$ ); and enhancing the ability to speak in front of people ( $P < 0.040$ ) [Table 3].

The results of open questions showed that the students do not like using the discussion board and weekly quizzes, which affect their grades, unclear PBL objectives, uninteresting scenarios, and they feel that PBL is time consuming. Furthermore, we requested our students to help us with their suggestions on how to improve our college PBL sessions and their response were as follows: college discussion board needs improvement; some students emphasized on the necessity of improving scenarios, and they also suggested that PBL workshops should be provided for students and facilitators.

## DISCUSSION

The present study was undertaken to assess perception of Saudi dental students regarding the PBL curriculum and to compare their perceptions among different sex and academic years. In the present study, 47.9% of participants reported that the PBL strategy is interesting. This may be due to the positive impact of PBL in improving communication skills (enhancing the ability to speak in front of people, enhancing acquiring new information, developing the problem solving skills, increasing the collaborative learning, making learning more interesting, improving the decision making skills, and motivating students for self-learning). This is in agreement with other Saudi studies which showed that PBL system helps developing student skills and majority of the students revealed that they are satisfied with the PBL system because it is superior to the traditional system.<sup>[2,12,14]</sup> Moreover, previous studies have also shown that 78% and 52.3% of the students perceived that PBL sessions were interesting<sup>[15,16]</sup> and help in improvement of knowledge, skills, and critical thinking abilities.<sup>[17-19]</sup> Callis *et al.* reported that students who enrolled in a hybrid PBL curriculum demonstrated a greater ability to apply basic science principles to a clinical scenario when compared to traditional lecture-based students. Consequently, this led to an increase in the student's skills in the areas of communication and hypothesis generation—which are necessary for interacting with other health professionals.<sup>[8]</sup> Moreover, the students in other study reported that their knowledge was unforgettable and easily recalled in PBL sessions in comparison with other teaching methods.<sup>[20]</sup> One can note that the students interested in PBL sessions are not constant in all years with a gradual increase in interested students starting from the first year (29.7%), peaking in the final year (70.0%). Al-Naggar and Bobryshev reported that the year factor significantly influences the acceptance of PBL

**Table 2: Comparison of the students' responses to the statements by academic year**

Statement	Y	SD/D	Uncertain	A/SA	$\chi^2$ (P)
		Number (%)	Number (%)	Number (%)	
1. The PBL strategy is interesting	1 <sup>st</sup>	11 (29.7)	15 (40.5)	11 (29.7)	24.327 (.083)
	2 <sup>nd</sup>	3 (14.3)	10 (47.6)	8 (38.1)	
	3 <sup>rd</sup>	6 (20.7)	7 (24.1)	16 (55.2)	
	4 <sup>th</sup>	11 (37.9)	4 (13.8)	14 (48.2)	
	5 <sup>th</sup>	4 (13.3)	5 (16.7)	21 (70.0)	
	Total	35 (24)	41 (28.1)	70 (47.9)	
2. The knowledge gained is more thorough than it would be by conventional teaching (lectures)	1 <sup>st</sup>	8 (21.6)	16 (43.2)	13 (35.1)	16.656 (.408)
	2 <sup>nd</sup>	9 (42.9)	7 (33.3)	5 (23.8)	
	3 <sup>rd</sup>	7 (24.1)	11 (37.9)	11 (37.9)	
	4 <sup>th</sup>	12 (41.3)	8 (27.6)	9 (31.0)	
	5 <sup>th</sup>	5 (16.6)	9 (30.0)	16 (53.3)	
	Total	41 (28.1)	51 (34.9)	54 (37)	
3. PBL is focused on real medical/dental problems making it more relevant to the interest	1 <sup>st</sup>	4 (10.8)	8 (21.6)	25 (67.5)	12.664 (.697)
	2 <sup>nd</sup>	2 (9.5)	4 (19.0)	15 (71.4)	
	3 <sup>rd</sup>	3 (10.3)	10 (34.5)	16 (55.1)	
	4 <sup>th</sup>	6 (20.6)	4 (13.8)	19 (65.5)	
	5 <sup>th</sup>	2 (6.7)	3 (10.0)	25 (83.4)	
	Total	17 (11.7)	29 (19.9)	100 (68.5)	
4. The student understands the objectives of the PBL session better if it has been lectured in the conventional way	1 <sup>st</sup>	10 (27.0)	13 (35.1)	14 (37.8)	20.466 (.200)
	2 <sup>nd</sup>	7 (33.3)	6 (28.6)	8 (38.1)	
	3 <sup>rd</sup>	11 (37.9)	13 (44.8)	5 (17.2)	
	4 <sup>th</sup>	13 (44.8)	6 (20.7)	10 (34.5)	
	5 <sup>th</sup>	6 (20.0)	11 (36.7)	13 (43.4)	
	Total	47 (32.2)	49 (33.6)	50 (34.2)	
5. Students assume responsibility for their own learning	1 <sup>st</sup>	0 (0.0)	10 (27.0)	27 (72.9)	27.392 (.037)*
	2 <sup>nd</sup>	1 (4.8)	5 (23.8)	15 (71.4)	
	3 <sup>rd</sup>	2 (6.8)	9 (31.0)	18 (62.1)	
	4 <sup>th</sup>	4 (13.8)	11 (37.9)	14 (48.3)	
	5 <sup>th</sup>	7 (23.3)	2 (6.7)	21 (70.0)	
	Total	14 (9.5)	37 (25.3)	95 (65.1)	
6. Students become active processors of information	1 <sup>st</sup>	3 (8.1)	7 (18.9)	27 (72.9)	14.792 (.540)
	2 <sup>nd</sup>	2 (9.6)	6 (28.6)	13 (61.9)	
	3 <sup>rd</sup>	4 (13.8)	7 (24.1)	18 (62.0)	
	4 <sup>th</sup>	9 (31.0)	3 (10.3)	17 (58.6)	
	5 <sup>th</sup>	6 (20.0)	5 (16.7)	19 (63.3)	
	Total	24 (16.4)	28 (19.2)	94 (64.4)	
7. Students activate prior knowledge and learn to elaborate and organize their knowledge	1 <sup>st</sup>	4 (10.8)	14 (37.8)	19 (51.3)	24.666 (.076)
	2 <sup>nd</sup>	4 (19.0)	4 (19.0)	13 (61.9)	
	3 <sup>rd</sup>	4 (13.8)	7 (24.1)	18 (62.1)	
	4 <sup>th</sup>	6 (20.6)	12 (41.4)	11 (37.9)	
	5 <sup>th</sup>	6 (20.0)	2 (6.7)	22 (73.3)	
	Total	24 (16.4)	39 (26.7)	83 (56.8)	
8. Some students dominate while others are passive in the discussion	1 <sup>st</sup>	2 (5.4)	12 (32.4)	23 (62.1)	22.905 (.116)
	2 <sup>nd</sup>	5 (23.8)	7 (33.3)	9 (42.8)	
	3 <sup>rd</sup>	3 (10.3)	10 (34.5)	16 (55.1)	
	4 <sup>th</sup>	1 (3.4)	4 (13.8)	24 (82.7)	
	5 <sup>th</sup>	0 (0.0)	6 (20.0)	24 (80.0)	
	Total	11 (7.6)	39 (26.7)	96 (65.7)	

Contd...

Table 2: Contd...

Statement	Y	SD/D Number (%)	Uncertain Number (%)	A/SA Number (%)	$\chi^2$ (P)
9. Current PBL-lecture hybrid system is better than the entirely lecture-based curriculum	1 <sup>st</sup>	14 (37.8)	13 (35.1)	10 (27.0)	13.226 (.656)
	2 <sup>nd</sup>	5 (23.8)	10 (47.6)	6 (28.6)	
	3 <sup>rd</sup>	7 (24.1)	10 (34.5)	12 (41.4)	
	4 <sup>th</sup>	6 (27.0)	8 (27.6)	15 (51.7)	
	5 <sup>th</sup>	8 (26.7)	8 (26.7)	14 (46.6)	
	Total	40 (27.4)	49 (33.6)	57 (39.1)	
10. PBL is effective without having lecture of same topic	1 <sup>st</sup>	23 (62.1)	7 (18.9)	7 (18.9)	17.151 (.376)
	2 <sup>nd</sup>	12 (57.2)	4 (19.0)	5 (23.8)	
	3 <sup>rd</sup>	19 (65.5)	4 (13.8)	6 (20.7)	
	4 <sup>th</sup>	13 (44.8)	13 (44.8)	3 (10.3)	
	5 <sup>th</sup>	16 (53.3)	8 (26.7)	6 (20.0)	
	Total	83 (56.8)	36 (24.7)	27 (18.4)	
11. Enhances the ability to find the information using the internet/library	1 <sup>st</sup>	2 (5.4)	8 (21.6)	27 (72.9)	17.874 (.331)
	2 <sup>nd</sup>	1 (4.8)	3 (14.3)	17 (81.0)	
	3 <sup>rd</sup>	2 (6.8)	1 (4.3)	26 (89.6)	
	4 <sup>th</sup>	2 (6.9)	5 (17.2)	22 (75.8)	
	5 <sup>th</sup>	2 (6.7)	1 (3.3)	27 (90.0)	
	Total	9 (6.2)	18 (12.3)	119 (81.5)	
12. Helps in identifying the areas of weakness for improvement	1 <sup>st</sup>	4 (10.8)	16 (43.2)	17 (45.9)	10.701 (.828)
	2 <sup>nd</sup>	3 (14.3)	6 (28.6)	12 (57.2)	
	3 <sup>rd</sup>	7 (24.1)	7 (24.1)	15 (51.7)	
	4 <sup>th</sup>	2 (6.9)	8 (27.6)	19 (65.5)	
	5 <sup>th</sup>	3 (10.0)	12 (40.0)	15 (50.0)	
	Total	19 (13)	49 (33.6)	78 (53.5)	
13. Enhances the ability to speak in front of people	1 <sup>st</sup>	0 (0.0)	3 (8.1)	34 (91.9)	17.789 (.122)
	2 <sup>nd</sup>	0 (0.0)	2 (9.5)	19 (90.4)	
	3 <sup>rd</sup>	2 (6.9)	1 (3.4)	16 (89.6)	
	4 <sup>th</sup>	1 (3.4)	2 (6.9)	26 (89.7)	
	5 <sup>th</sup>	1 (3.3)	1 (3.3)	28 (93.3)	
	Total	4 (2.7)	9 (6.2)	133 (91.1)	
14. Increases ability to manage the time effectively	1 <sup>st</sup>	8 (21.6)	15 (40.5)	14 (37.8)	23.885 (.092)
	2 <sup>nd</sup>	9 (42.8)	3 (14.3)	9 (42.8)	
	3 <sup>rd</sup>	9 (31.0)	7 (24.1)	13 (44.8)	
	4 <sup>th</sup>	5 (17.2)	9 (31.0)	15 (51.7)	
	5 <sup>th</sup>	2 (6.7)	12 (40.0)	16 (90.1)	
	Total	33 (22.6)	46 (31.5)	67 (45.8)	
15. Helps to convert from passive to active life long learner	1 <sup>st</sup>	5 (13.5)	14 (37.8)	18 (48.6)	15.773 (.469)
	2 <sup>nd</sup>	3 (14.3)	11 (52.4)	7 (33.3)	
	3 <sup>rd</sup>	1 (3.4)	8 (27.6)	20 (68.9)	
	4 <sup>th</sup>	3 (10.3)	8 (27.6)	18 (62.1)	
	5 <sup>th</sup>	3 (10.0)	12 (40.0)	15 (50.0)	
	Total	15 (10.3)	53 (36.3)	78 (53.4)	
16. The role of facilitator in the process is helpful	1 <sup>st</sup>	6 (16.2)	13 (35.1)	18 (48.6)	27.780 (.034)*
	2 <sup>nd</sup>	1 (4.8)	5 (23.8)	15 (71.4)	
	3 <sup>rd</sup>	4 (13.8)	12 (41.4)	13 (44.8)	
	4 <sup>th</sup>	2 (6.9)	11 (37.9)	16 (55.1)	
	5 <sup>th</sup>	6 (20.0)	6 (20.0)	18 (60.0)	
	Total	19 (13)	47 (32.2)	80 (54.8)	
17. Improves the decision making skills	1 <sup>st</sup>	6 (16.2)	8 (21.6)	23 (62.1)	14.752 (.543)
	2 <sup>nd</sup>	0 (0.0)	5 (23.8)	16 (76.2)	
	3 <sup>rd</sup>	3 (10.3)	4 (13.8)	22 (75.8)	
	4 <sup>th</sup>	3 (10.3)	8 (13.8)	18 (75.8)	
	5 <sup>th</sup>	1 (3.3)	11 (36.7)	18 (60.0)	
	Total	13 (8.9)	36 (24.7)	97 (66.4)	

Contd...



Table 2: Contd...

Statement	Y	SD/D Number (%)	Uncertain Number (%)	A/SA Number (%)	$\chi^2$ (P)
18. Improves the problem solving skills	1 <sup>st</sup>	3 (8.1)	11 (29.7)	23 (62.2)	26.115 (.052)
	2 <sup>nd</sup>	2 (9.2)	8 (38.1)	11 (52.4)	
	3 <sup>rd</sup>	3 (10.3)	1 (3.4)	25 (86.2)	
	4 <sup>th</sup>	2 (6.8)	2 (6.9)	25 (86.2)	
	5 <sup>th</sup>	6 (20.0)	4 (13.3)	20 (66.7)	
	Total	16 (10.9)	26 (17.8)	104 (71.3)	
19. Enhances the practice of co-operative and collaborative learning	1 <sup>st</sup>	1 (2.7)	15 (40.5)	21 (56.7)	13.433 (.338)
	2 <sup>nd</sup>	1 (4.8)	6 (28.6)	14 (66.6)	
	3 <sup>rd</sup>	1 (3.4)	3 (10.3)	25 (86.2)	
	4 <sup>th</sup>	3 (10.3)	8 (27.6)	18 (62.0)	
	5 <sup>th</sup>	2 (6.7)	5 (16.7)	23 (76.7)	
	Total	8 (5.5)	37 (25.3)	101 (69.2)	

\*SD, Strongly disagree; D, Disagree; A, Agree; SA, Strongly agree; \*, Statistically significant at  $P < 0.05$

among medical students.<sup>[16]</sup> A possible explanation of this phenomena related to the students' progress from first to the following year was that they usually started to adapt to the PBL strategy gradually.

On the other hand, some of the students reported a negative perception towards PBL and the reason was that some students dominate while others are passive in the PBL discussion. This could be attributed to the different behavioral performance and learning style of the students in PBL classes.<sup>[21]</sup> Azer *et al.* addressed the factors that may affect group interactions, which included students' and tutors' perceptions, tutor's background, tutor's group dynamics, student's training, and the characteristics of the problem used.<sup>[22]</sup> Furthermore, poor participation of some students during PBL class could be attributed to many factors, for example, students' prior knowledge of the content of scenario, English proficiency, the facilitator does not ensure effective participation of all the students, and poor communication between the group members.<sup>[9]</sup> Therefore, educational planners should ensure an adequate mix of students with different learning styles in the PBL groups to achieve the desired objectives, students should be informed about their learning style, and they should learn strategies to compensate for any lacks in PBL sessions through self-study.<sup>[21]</sup> However, Samarji suggested that as the students, around the world learn in different ways, some of them may not be compatible with a problem-based approach, therefore, using a variety of strategies will help to ensure that the different needs and capabilities of the students are addressed.<sup>[23]</sup>

This study indicated that 56.8% of the participants reported that PBL is not effective without having a lecture on the same topic. This showed that the

students are still in favor of hybrid curriculum that includes some elements of PBL with traditional methods (lectures). As conventional teaching methods rely more on the tutor and readymade materials, in real life it does not teach the students the attributes required as a health professional for problem solving, efficient use of resources, and how to acquire an eagerness for knowledge.<sup>[13]</sup> Choi *et al.* compared Korean nursing student's perception regarding PBL and lecture-based learning (LBL) and revealed that students in the PBL group showed superior abilities in problem solving, self-directed learning, and critical thinking.<sup>[10]</sup>

Other recent studies suggested that in the PBL-based curriculum students performed significantly better than the didactic lecture-based curriculum students in both the theoretical knowledge and clinical examination.<sup>[24]</sup> Similar finding was also reported in other studies.<sup>[11,25,26]</sup> Comparison of the students' responses according to the academic year showed significant differences among different academic years (students assume responsibility for their own learning;  $P = 0.037$ ). Among all academic years, first-year students reported a higher percentage for self-learning (72%), which is probably due to the fact that these students are not yet used to seek help from other or they may not know from where they can get support during or after PBL sessions. When students perceive responsibility of their own learning process through their involvement in independent and self-directed studying, it can make them professionally different.<sup>[27,28]</sup>

In the present study, more than half of the participants (54.8%) agreed that the role of facilitator in the process is helpful, with a statistically significant difference among different academic years. This can be explained by different expectations of the students regarding

**Table 3: Comparison of the students' responses to the statements by gender**

Statements	Gender	SD/D	Uncertain	A/SA	P
		Number (%)	Number (%)	Number (%)	
1. The PBL strategy is interesting	Male	15 (22.8)	16 (24.2)	35 (53.0)	0.122
	Female	20 (25.1)	25 (31.3)	35 (43.8)	
2. The knowledge gained is more thorough than it would be by conventional teaching (lectures)	Male	20 (30.3)	24 (36.4)	22 (33.4)	0.544
	Female	21 (26.3)	27 (33.8)	32 (40.0)	
3. PBL is focused on real medical/dental problems making it more relevant to the interest	Male	8 (12.1)	14 (21.2)	44 (66.6)	0.335
	Female	9 (11.3)	15 (18.8)	56 (70.0)	
4. The student understand the objectives of the PBL' session better than conventional way	Male	19 (28.8)	21 (31.8)	26 (39.4)	0.040*
	Female	28 (35.1)	28 (35.0)	24 (30.1)	
5. Students assume responsibility for their own learning	Male	11 (16.7)	21 (31.8)	34 (51.5)	0.003*
	Female	3 (3.8)	16 (20.0)	61 (76.3)	
6. Students become active processors of information	Male	17 (25.7)	13 (19.7)	36 (54.6)	0.046
	Female	7 (8.8)	15 (18.8)	58 (72.5)	
7. Students activate prior knowledge and learn to elaborate and organize their knowledge	Male	17 (25.7)	21 (31.8)	28 (42.4)	0.009*
	Female	7 (8.8)	18 (22.5)	55 (68.8)	
8. Some students dominate while others are passive in the discussion	Male	3 (4.5)	19 (28.8)	44 (66.7)	0.618
	Female	8 (10.0)	20 (25.0)	52 (65.0)	
9. Current PBL-lecture hybrid system is better than the entirely lecture-based curriculum	Male	19 (28.8)	19 (28.8)	28 (42.4)	0.232
	Female	21 (26.3)	30 (37.5)	29 (36.3)	
10. PBL is effective without having lecture of same topic	Male	33 (50.0)	15 (22.7)	18 (27.3)	0.025*
	Female	50 (62.6)	21 (26.3)	9 (11.3)	
11. Enhances the ability to find the information using the internet/library	Male	7 (10.6)	12 (18.2)	47 (71.2)	0.014*
	Female	2 (2.5)	6 (7.5)	72 (90.0)	
12. Helps in identifying the areas of weakness for improvement	Male	10 (15.2)	21 (31.8)	35 (53.0)	0.031*
	Female	9 (11.3)	28 (35.0)	43 (53.8)	
13. Enhances the ability to speak in front of people	Male	0 (0.0)	7 (10.6)	59 (89.4)	0.040*
	Female	4 (5.0)	2 (2.5)	74 (92.5)	
14. Increases ability to manage the time effectively	Male	11 (16.6)	22 (33.3)	33 (50.0)	0.221
	Female	22 (27.6)	24 (30.0)	34 (42.5)	
15. Helps to convert from passive to active life long learner	Male	6 (9.1)	28 (42.4)	32 (48.5)	0.075
	Female	9 (11.3)	25 (31.3)	46 (57.6)	
16. The role of facilitator in the process is helpful	Male	4 (6.1)	19 (28.8)	43 (65.1)	0.065
	Female	15 (18.8)	28 (35.0)	37 (46.3)	
17. Improves the decision making skills	Male	6 (9.1)	16 (24.2)	44 (66.6)	0.884
	Female	7 (8.8)	20 (25.0)	53 (66.3)	
18. Improves the problem solving skills	Male	9 (13.6)	9 (13.6)	48 (72.7)	0.470
	Female	7 (8.8)	17 (21.3)	56 (70.0)	
19. Enhances the practice of cooperative and collaborative learning	Male	5 (7.6)	18 (27.3)	43 (65.2)	0.302
	Female	3 (3.8)	19 (23.8)	58 (72.5)	

facilitators' role. Tutors are expected to act as a facilitator to the tutorials and not an information provider. In addition, the tutor should ensure effective group dynamics through encouraging active involvement of all the students.<sup>[27,29]</sup> This view is in agreement with a finding, which reported that 73% of the students feel that the tutor has an essential role in PBL.<sup>[12]</sup> Chang *et al.* reported that average students (in comparison with students who are academically stronger) may depend more on the tutor to guide and motivate them in order to achieve their learning goals.<sup>[30]</sup> Other studies reported that students preferred tutors who had knowledge in

both basic and clinical science areas, had appropriate facilitative tutorial skills, and had positive personality traits.<sup>[31,32]</sup> Stimulating active and self-directed learning are perceived as tutors' most important tasks with regard to problem quality and group functioning.<sup>[33]</sup> New attitudes and skills may be required from the teaching faculty so that they are willing and competent to deal with the PBL method. Therefore, there is a need for proper tutor training (to understand the methodology of PBL) as it is an essential step for the success of PBL sessions so that they can manage the learning process better.<sup>[34,35]</sup>

Our current study also showed a statistically significant difference between male and female students in many variables (ranging from assuming responsibility for own learning to understanding the objectives of the PBL sessions better than the conventional ones). One explanation of these differences could be related to the way that female and male students learn and function in education. There have been few studies relating gender and PBL with little significance in response to PBL. For example, Reynolds found that women trusted the information provided by other students more than men, and they enjoyed taking responsibility for their own learning, which is in the agreement with this study.<sup>[36]</sup> When we asked the students about the things they do not like, the students stated that, using the discussion board and weekly quizzes which affect their grades include unclear PBL objectives, uninteresting scenarios, and finally it is time consuming. A similar finding reported that participants feel that PBL is too time consuming.<sup>[9,32,37]</sup> The time consumption in PBL might be due to long literature searches, posting the literature search in the discussion board, and finally preparing the presentations. In summary, our result showed that a majority of the students positively responded to the statements assessing the benefits of PBL. Therefore, the objective of conducting PBL as one of the main teaching methods at Qassim College of dentistry was achieved.

In a systematic review which was conducted by Bassir *et al.*, the authors suggested that the number of studies in dental education on the effectiveness of PBL, especially on the entire curriculum level, is very limited, and there is no convincing evidence in support of PBL for developing the clinical skills of the dental students.<sup>[38]</sup> Despite this, PBL has been shown to be a satisfactory and effective instructional strategy for undergraduate students.<sup>[39,25]</sup> The evidence from this study suggests that PBL has a positive effect on students' skills which can also improve the ability of students in applying their knowledge in the clinical setting.

The effectiveness of PBL was demonstrated in the increased overall critical thinking scores from homogeneous studies on a meta-analysis, which was conducted among undergraduate nursing students.<sup>[40]</sup>

The limitations of this study included, first, low response rate. This is probably due to the lack of knowledge about the importance of the research. Second, the male and female students are in separate campus with different facilitators, and can thus have different perceptions. Finally, the PBL activities in

our setup were done in two sessions and may not be representative of all kinds of PBL exercises, as they vary among institutions. In brief, the PBL is a relatively new method of learning compared to the more traditional system; PBL tries to provide the students with the essential skills for efficient professional development. Future studies are needed to address the effect of PBL on the clinical skills of dental students and to compare the knowledge and skills of PBL graduates with conventional curricula students. The comparison between these approaches and with different learning techniques such as Team Base Learning (TBL) regarding dental treatment and patients' satisfaction could also be considered for advanced levels of evaluation.

## CONCLUSION

Perception of Saudi dental students regarding their education environments at Qassim College of Dentistry using PBL hybrid curriculum was more positive than negative. However, improvements are still required to provide students with stimulating favorable learning environment and to take the students recommendations into consideration.

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## Conflicts of interest

There are no conflicts of interest.

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