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Comparison of Perception and Academic Outcome of Final Year BDS Students Regarding Lecture-Based Learning and Problem-Based Learning

Aamna Khalil[1], Ammarah Afreen[2*], Sadaf Amjad[2], Zarah Afreen[1], Muhammad Omer Siddiqui[3] and Qudsia Iqbal[4]

[1]Department of Prosthodontics, Watim Medical and Dental College, Rawalpindi, Pakistan
[2]Department of Operative Dentistry and Endodontics, Watim Medical and Dental College, Rawalpindi, Pakistan
[3]Department of Orthodontics, Army Medical College, National University of Medical Sciences, Rawalpindi, Pakistan
[4]Department of Prosthodontics, Nishtar Institute of Dentistry, Multan, Pakistan

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***Corresponding Author:**
Ammarah Afreen
Department of Operative Dentistry and Endodontics, Watim Medical and Dental College, Rawalpindi, Pakistan
ammarahafreen@gmail.com

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ABSTRACT

This study explores the differences in student perception and academic outcomes between traditional lecture-based learning and problem-based learning methods in an educational setting. **Objective:** To find the effectiveness of Problem-Based Learning (PBL) versus Lecture-Based Learning (LBL) in enhancing academic performance and student satisfaction. **Methods:** Comparative cross-sectional study was carried out among final year BDS students at Watim Medical and Dental College Rawalpindi. The study evaluated lecture-based learning (LBL) versus problem-based learning (PBL) in Prosthodontics and Operative dentistry. LBL consisted of interactive lectures with clear objectives, while PBL involved group-based problem solving over two months. Academic outcomes were assessed via class tests, with feedback gathered through a structured questionnaire. Data were analyzed using SPSS version 21.0. **Results:** A total of 131 final year BDS students were included. Both genders were considered however majority were females (74%). Mostly participants appreciated both teaching methodologies (58%), a significant proportion favored lecture-based learning (26%) over problem-based learning (11.5%). Perceptions varied on the effectiveness of each method in fostering understanding, self-learning habits, and analytical skills. Many participants expressed dissatisfaction with resource availability and syllabus coverage in PBL sessions, despite positive views on facilitator training. Exam results showed a higher pass rate with PBL (76.3%) compared to LBL (56.5%), but satisfaction with PBL did not significantly influence exam outcomes ($p>0.05$). **Conclusions:** The study concluded that future research should focus on optimizing educational methodologies in dental education to effectively prepare students for the complex demands of healthcare through innovative and balanced approaches.

INTRODUCTION

There is always a quest for exploring the most effective learning method. This led to origination of student oriented innovative techniques like problem-based learning (PBL), case-based learning (CBL) and team-based learning (TBL) [1]. PBL is one of the most successful methods in which student should lead their own learning trail. The original idea of PBL was proposed and initiated by Barrows and Tamblyn at McMaster University (Canada) in 1969 [2]. Later the strategy was applied in Europe and other parts of the world in medical and other sciences [3]. The indigenous strategy was to present a problem or problematic scenario and then motivate the students to find the appropriate solution. The activity is usually done in small groups (8 to 10 students) along with an instructor. Identifying the problem, brain-storming ideas, researching and discussing the solutions are the various steps followed in this student-centered learning process [4,5]. Interactive lectures are one of the oldest and widely used teaching methods in medical education. The students are fond of this method because the teacher covers the entire topic. So, the student's time is saved. They take notes and prepare the topic [6]. When it comes to base wisdom, teaching methods that involve active participation of the students and enhance self-facilitated learning can be ground-

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breaking [6, 7]. Currently, conventional lectures are evolving and continuously changed by team-based learning like the introduction of problem-based learning [8]. PBL is a teaching method that not only have a positive impact on academic performance of the students but it also greatly enhances the communication skills, self-learning abilities, problem solving skills, independent working abilities as well as team work [9, 10]. As the students first experience the problem situations and then proceed with self-directed learning, it also increases students' metacognitive awareness levels as compared to the traditional teaching methods [11]. Studies show that there is increase long term knowledge retention in problem-based learning as compared to conventional lecture-based learning [12]. Despite the global shift towards more interactive and student-centered learning approaches like Problem-Based Learning (PBL), there is a paucity of research evaluating its effectiveness compared to traditional Lecture-Based Learning (LBL) within the context of dental education in Pakistan.

This study aimed to fill this gap by providing a comparative analysis of PBL and LBL, thereby contributing valuable insights that could guide future curriculum development and pedagogical strategies in Pakistan's dental schools.

METHODS

A comparative cross-sectional study was conducted among final year BDS students at Watim medical and dental college Rawalpindi. Study was conducted in the lectures of Prosthodontics and Operative dentistry after approval granted by the hospital ethical review board under letter no:WM&DCR/R&D(ERB)/2023/85. Convenience method was used for sampling. Sample size was 131 calculated by WHO calculator. Level of significance was 5%, power of the test was 95%, test value of population mean was 3.32, anticipated population mean was 3.81, population standard deviation was 1.205, n=131[13]. The duration of study was 4 months from November 2023 to March 2024. A questionnaire was constructed with 19 questions. It recorded the demographic details in first portion and the feedback about the teaching method in later questions. Students were taught for two months by conventional lecture-based learning (LBL) and feedback was recorded using questionnaire. Then they were taught by problem-based learning (PBL) for next two months and feedback was recorded. In this study LBL refers to the interactive lectures. The lectures were delivered through power point presentations with clear learning objectives and students were involved in summarizing the lecture at the end. In PBL method, 2 lectures were utilized to cover one topic. In first lecture, students were divided in small groups (8-10 students). Then a problem based clinical scenario or question was presented to students and they were instructed to work together to solve it in class and also at home using books, articles and other sources from internet. In the next lecture the teacher facilitated open discussion among groups. At the end feedback was recorded using the questionnaire. Students were also asked about their contentment with either of the teaching methods and their overall satisfaction with the resources and facilities available for each. Assessment was done at the end of two months to record and compare the academic outcome of each method. Subjects scoring at least 50% in the assessment were declared as passed, while those scoring less than 50% were declared as failed. For this purpose, class tests were conducted on completion of topics done by both teaching methods and percentages were calculated and compared. Data were collected and analyzed by using SPSS version 21.0. Responses of the participants were presented as frequency and percentage for categorical variables. To determine the association between PBL and LBL with the exam results, the Chi-square test for association was applied, with a confidence level of 95% and a significance level of 5%.

RESULTS

The study population comprised on 131 participants with the mean age of 23.27±1.27 years, out of which 97 (74%) females and 34 (26%) male participants. Amongst the study population, majority (69; 52.3%) were day scholars. All of the participants attended both of the sessions and were assessed after the completion of the sessions. All of the participants attended both of the sessions and were assessed after the completion of the sessions. 76 (58%) of the participants liked both of the methodologies, though 34(26%) liked lecture-based learning (LBL) and 15 (11.5%) liked problem-based learning (PBL). 66 (50.4%) of the study participants were of the view that both of the strategies lead to better understanding. 56 (42.7%) of the participants were of the view that the habit of self-learning is inculcated by PBL method, while 47 (35.9%) claims that both of the methods inculcate self-learning. 56 (42.7%) said that both of the methods lead to better analytical approach towards a problem. 72 (55%) of the participants said that both of the methods lead to more clarification of concepts (Table 1).

Table 1: Responses of Study Population (n=131)

Variables		Frequency (%)
Gender	Female	97 (74%)
	Male	34 (26%)
Housing	Day Scholar	69 (52.7%)
	Hostelite	62 (47.3%)
Age (in years)	21	9 (6.9%)
	22	28 (21.4%)
	23	37 (28.2%)

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	24	43 (32.8%)
	25	7 (5.3%)
	26	4 (3.1%)
	27	3 (2.3%)
Which Teaching Methods is liked	Lecture Based Learning	34 (26%)
	Problem Based Learning	15 (11.5%)
	Both A and B	76 (58%)
	Any other	6 (4.6%)
Which Methods Leads to Better Understanding	Lecture Based Learning	35 (26.7%)
	Problem Based Learning	25 (19.1%)
	Both A and B	66 (50.4%)
	Any Other	5 (3.8%)
The Habit of Self-Learning is Inculcated by	LBL	22 (16.8%)
	PBL	47 (35.9%)
	Both a and b	56 (42.7%)
	Any other	6 (4.6%)
Which Method Leads to Better Analytical Approach towards Problem	LBL	35 (26.7%)
	PBL	36 (27.5%)
	Both	56 (42.7%)
	Any other	4 (3.1%)
Which Method Leads to more Clarification of Concepts	LBL	31 (23.7%)
	PBL	24 (18.3%)
	Both	72 (55%)
	Any other	4 (3.1%)
Satisfied with the Availability of Resources for PBL Sessions	yes	51 (38.8%)
	no	72 (55%)
	Don't know	8 (6.1%)
Enough Syllabus is Covered by PBL Sessions	yes	47 (35.9%)
	no	65 (49.6%)
	Don't know	19 (14.5%)
Facilitators are Well Trained to Conduct PBL Sessions	yes	91 (69.5%)
	no	18 (13.7%)
	Don't know	22 (16.8%)
Satisfied with Lectures Concurrent with PBL	yes	57 (43.5%)
	no	46 (35.1%)
	Don't know	28 (21.4%)
Result of PBL Exams	Pass	100 (76.3%)
	Fail	31 (23.7%)
Result of LBL Exams	Pass	74 (56.5%)
	Fail	57 (43.5%)

72 (55%) participants were not satisfied with the availability of resources for PBL sessions. However, 65 (49.6%) of the participants reported that enough syllabus was not covered by PBL sessions. 91(69.5%) said that facilitators were well trained to conduct PBL sessions. Although, 57 (43.5%) of the participants were satisfied with lectures concurrent with PBL. While 46 (35.1%) were not satisfied with the concurrent lectures with PBL. Majority of the participants (76.3%) passed the PBL exam, however 56.5% passed the LBL exam (Figure 1).

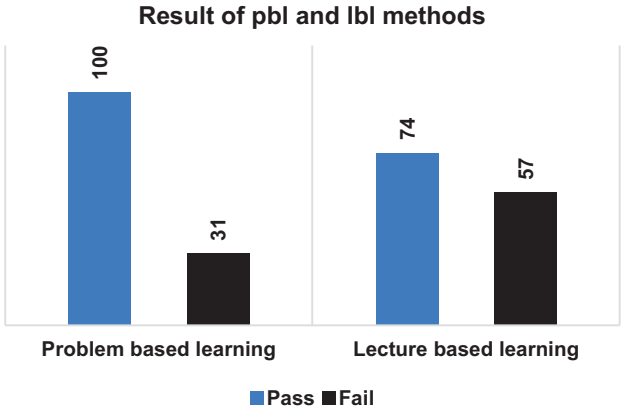

Figure 1: Result of Problem-Based Learning and Lecture-Based Learning (n=131)

The satisfaction level of the study participants was compared with the result of PBL. The study findings predicts that those who were not satisfied with the PBL method, passed the exam but none of the findings were statistically significant (p>0.05) as mentioned in Table 2.

Table 2: Comparison of Satisfaction Level of Study Population with PBL Result (N=131)

Responses of Participants Regarding PBL Method			Result of PBL Exam: Pass	Result of PBL Exam: Fail	p-Value
Satisfied with the Availability of Resources for PBL Sessions	Yes	n	35	16	0.230
		%	35.0%	51.6%	
	No	n	59	13	
		%	59.0%	41.9%	
	Don't know	n	6	2	
		%	6.0%	6.5%	
Enough Syllabus is Covered by PBL Sessions	Yes	n	36	11	0.957
		%	36.0%	35.5%	
	No	n	50	15	
		%	50.0%	48.4%	
	Don't know	n	14	5	
		%	14.0%	16.1%	
The Facilitators were Well Trained to Conduct PBL Sessions	Yes	n	69	22	0.338
		%	69.0%	71.0%	
	No	n	12	6	
		%	12.0%	19.4%	
	Don't know	n	19	3	
		%	19.0%	9.7%	
Satisfied with Lectures Concurrent with PBL	Yes	n	45	12	0.861
		%	45.0%	38.7%	
	No	n	34	12	
		%	34.0%	38.7%	
	Don't know	n	21	7	
		%	21.0%	22.6%	

The study participant's satisfaction level was compared with LBL level and satisfactory findings were observed only with the 'facilitators that they were well trained to conduct sessions' with the participants who passed the LBL exam (73%) but the findings were non-significant (p>0.05). The

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findings predict that satisfaction level has no relation with LBL exam results (Table 3).

Table 3: Comparison of Satisfaction Level of Study Population with LBL Result (N=131)

Responses of participants regarding LBL method			Result of LBL Exam		p-Value
			Pass	Fail	
Satisfied with the Availability of Resources	Yes	n	32	19	0.508
		%	43.2%	33.3%	
	No	n	38	34	
		%	51.4%	59.6%	
	Don't know	n	4	4	
		%	5.4%	7.0%	
Enough Syllabus is Covered	Yes	n	29	18	0.421
		%	39.2%	31.6%	
	No	n	33	32	
		%	44.6%	56.1%	
	Don't know	n	12	7	
		%	16.2%	12.3%	
The Facilitators were Well Trained to Conduct Sessions	Yes	n	54	37	0.497
		%	73.0%	64.9%	
	No	n	8	10	
		%	10.8%	17.5%	
	Don't know	n	12	10	
		%	16.2%	17.5%	
Satisfied with Lectures	Yes	n	36	21	0.419
		%	48.6%	36.8%	
	No	n	23	23	
		%	31.1%	40.4%	
	Don't know	n	15	13	
		%	20.3%	22.8%	

DISCUSSION

The current study explores dental students' perceptions of problem-based learning (PBL) and lecture-based learning (LBL), revealing diverse preferences. While many participants appreciated both methods, a significant portion favored LBL for its traditional approach. Nonetheless, PBL was recognized for promoting self-learning and analytical skills. Concerns about resource availability and syllabus coverage were noted, impacting PBL satisfaction. Facilitator training for PBL was generally seen as adequate, despite some dissatisfaction with concurrent lectures. Although PBL showed a higher exam pass rate compared to LBL, satisfaction levels did not correlate significantly with exam outcomes. A comprehensive review of teaching methodologies in medical and dental education globally reveals a shift towards innovative approaches aimed at enhancing learning outcomes and preparing students for clinical practice. The medical educators are facing greater challenges in order to meet the rapid development in health care needs arising globally and the relative lag in comprehensive teaching methods [14]. Prosperously, numerous researchers conducted studies on atypical pedagogies and models. These constitute methods like flipped classrooms, blended learning (combining more than single method), inquiry-based learning, problem-based learning and online learning [15,16]. Other studies found that the traditional lecture-based learning (LBL) model was used widely lags behind when it comes to problem-solving, collaborative learning and critical thinking [17, 18]. Various researchers have proposed different numbers of steps that are included in Problem-based learning (PBL). But most common of these are four steps namely: problem definition, research, implementation, reflection and evaluation [19]. Problem-Based Learning (PBL) is recognized for fostering critical thinking and self-directed learning, though comparisons with traditional lecture-based methods show varied impacts on student satisfaction and academic performance. Lecture-Based Learning (LBL) remains prevalent for its structured delivery of content, while adaptations like flipped classrooms are explored for their potential to improve engagement and retention. However, our study showed that 58% of the students were fond of both of the methodologies, while only 26% of students like lecture-based learning. These results are similar to study done by Yue et al., In their study, 46% students were fond of both methodologies, while 14% of students liked lecture-based learning [20]. While in contrast of ours, study done by Solomon Y, showed that 63.2% of students preferred lecture-based learnings while 36.6% preferred problem-based learning [21]. A meta-analysis and systematic review done by Zheng QM, et al., showed that problem-based learning was superior in clinical competence and student satisfaction compared to lecture-based learning [22]. This study showed contradictory results compared to our study. Problem-Based Learning (PBL) is increasingly recognized for its effectiveness in simulating real-world scenarios and seamlessly integrating theoretical knowledge with practical skills, making it a vital component of modern educational strategies in healthcare. This approach not only enhances critical thinking and problem-solving abilities but also fosters a deeper understanding of the material by engaging students in active learning. The varied outcomes and preferences among students for PBL and LBL highlight the need for a more personalized educational approach that caters to different learning styles and career aspirations. In the current study, a significant majority of participants (76.3%) successfully passed the PBL exam, compared to 56.5% who passed the LBL exam, indicating a clear advantage of PBL in promoting academic success. These findings are consistent with previous research by Pan et al., [14], Nakhjiri et al., [23], and O'Dea XC et al., [24] where the PBL groups demonstrated significantly higher examination scores—around 80%—compared to the

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control groups, which had an average pass rate of 39.4%. This consistent trend underscores the effectiveness of PBL in improving academic outcomes. Moreover, the successful implementation of PBL relies heavily on the quality of faculty training. Educators must be adept at designing and delivering PBL sessions, which require a different set of instructional skills compared to traditional lectures. Faculty training programs must emphasize the importance of instructional design and assessment methods that align with evolving educational paradigms in healthcare. These findings suggest that dental schools should consider integrating more PBL into their curricula to enhance student engagement and academic performance. However, the complexity of educational methodologies also indicates that a one-size-fits-all approach may not be sufficient [24]. Tailored educational strategies that incorporate both PBL and LBL, adjusted to the specific needs and learning preferences of students, could offer a more balanced and effective educational experience [25]. Future research should explore how these methodologies can be optimized and blended to better prepare dental students for the diverse challenges they will face in their professional careers. Furthermore, curriculum enhancement efforts should focus on creating a dynamic learning environment that supports the development of both theoretical knowledge and practical skills, ensuring that graduates are well-equipped to meet the demands of the ever-changing healthcare landscape. The study's limitations include a small, single-institution sample size and the use of convenience sampling, which may limit the generalizability and introduce bias. Additionally, the short duration of four months and reliance on class tests may not adequately capture long-term outcomes or fully assess the complexities of student learning, suggesting a need for more comprehensive evaluation methods.

CONCLUSIONS

The study concluded that both PBL and LBL offer valuable benefits in dental education, highlighting the importance of integrating innovative approaches with traditional teaching methods. For educators in dental schools, these findings suggest the need to balance foundational knowledge delivery with methods that enhance critical thinking and problem-solving skills. To better prepare students for the evolving demands of the healthcare system, educators should consider incorporating more PBL elements into their curriculum, ensuring that students are not only receiving information but also learning how to apply it in real-world, unpredictable situations.

Authors Contribution

Conceptualization: AK
Methodology: AK, SA
Formal analysis: AA, MOS
Writing, review and editing: AA, ZA, MOS, QI

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

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