Research Article

Randomized Blinded Control Trial: Comparing Problem-Based Learning and Lecture-Based Learning in Post-Graduation Medical Short Course among Medical Interns in Al Ahsa Saudi Arabia

Al Joher Abdullatif[1*], Al Jasim Abdullah[1], Al Huwail Abdullah[2], Al Jamaan Mohammed[3], Al Joher Abdualbary[4]

[1]Family Medicine Associated Consultant, King Abdulaziz Hospital for National Guard, Al Ahsa, Saudi Arabia
[2]Department of Family Medicine, King Abdulaziz Hospital for National Guard, Al Ahsa, Saudi Arabia
[3]Preventive Medicine Consultant, King Abdulaziz Hospital for National Guard, Al Ahsa, Saudi Arabia
[4]Department of Emergency Medicine, King Fahad Hospital Hofuf, Al Ahsa, Saudi Arabia

[*]**Corresponding Author:** Al Joher Abdullatif, Family Medicine Associated Consultant, King Abdulaziz Hospital for National Guard, Al Ahsa, Saudi Arabia

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Abstract

Background: In the last years, the medical education advancement concurred with the phenomenal development in medical practice.

Objectives: Study aims to compare between problem-based learning (PBL) and lecture-based learning (LBL) in post-graduation medical short course among medical interns.

Methods: A randomized blinded control trial was conducted among medical interns in July 2019 to compare between PBL and LBL in explanation for short medical course about Adolescent health. It used a validated questionnaire for measuring the attitude of the educational method and pre-posttest for both

groups. Nor study investigator or participants were aware of randomization process and groups' assignment. Study used the Statistical Package for Social Sciences (SPSS) for data analysis.

Results: Fourteen medical interns in every group participated in the study. Interns in PBL group noticed that it was stimulating (85.7%), ease (35.7%), useful (71.4%), powering (92.8%) and enlightening (71.4%). The mean (SD) posttest score of intervention group was 13.85 (3.08) compared to 16.64 (1.64) in the other group (P<.01). Also, mean posttest score was 1.35 (2.76) in PBL group compared to 4.21 (2.42) in LBL (P<.01).

Conclusions: Lecture-based learning is less attractive and more effective than problem-based learning in short duration medical courses for post-graduate education medical interns.

Keywords: Problem-based learning; Lecture-based learning; Medical education; Randomized clinical trial; Saudi arabia

Abbreviations: PBL: Problem-based learning; LBL: Lecture-based learning; KAHNG: King Abdulaziz Hospital for National Guard; MCQ: Multiple choice questions; SPSS: Statistical package for social sciences; KSAUHS: King Saud bin Abdulaziz University for health sciences

1. Background

Problem-based learning (PBL) is a method of education where students acquire knowledge by working through problems, pursuing self-directed learning, and discussing topics in small groups. The learning method challenges students to evaluate, analyze, think, rethink, infer and synthesize information [1]. It is more student-centered that enable students to apply the acquired knowledge for solving real-life problems, connect real clinical problems to the theoretical learning concepts and acquire better vocational and clinical reasoning skills with real-world experiences in addition to develop learning autonomy and gain motivation [2, 3]. Lecture-based learning (LBL) on the other side involves training students to recite, describe, define and list of factual knowledge through presenting a didactic lecture without practice usually [1, 2]. Although, both educational methods differ in terms of application, style, engagement, and mastery of concepts among students. Nevertheless, all learning styles contribute to knowledge sharing and cognitive development despite the efficacy and applicability differences [3, 4].

However, previous observational [1, 5-7], quasi-experimental [2, 3, 8] and experimental studies [4, 9-13] in this subject compared the educational performance of PBL and LBL mainly among university pre-graduate students in different specialties using different measurements and founding different results. As well, outcomes of those studies included mean score, educational performance, attitude, and satisfaction toward learning. Compared to literature, this study tried to fill the gap of short courses post-graduate medical learning. It answered the question of "Is there a difference between PBL and LBL in short courses post-graduation medical education among physicians in the internship?". Study aims to compare the learning outcomes, performance, attitude, and motivation among medical interns.

2. Methods

A randomized blinded control trial included physicians in internship year "regardless of medical specialty" who were training in King Abdulaziz Hospital for National Guard (KAHNG) Al Ahsa, Saudi Arabia during July 2019. A minimum calculated sample size was 10 in every group using two independent means difference equation for sample size estimation. It assumed that 2.3 standard deviation score difference between PBL and LBL [6], 2% accuracy and 95% confidence interval (95%CI). Out of 45 participants who were training at study time, 28 interns were selected from the internship list "sampling reference" using of systematic random sampling technique of every second name. Study investigator contacted all selected interns for explaining study aim and confirming their attendance in the experiment by taking preliminary verbal consent. After that, 14 interns were allocated to two comparable groups using block randomization technique (through coding system AABB). Nor study investigator or the participants were aware of the process of randomization selection, allocation, and group assignment.

During the experiment, both PBL and LBL groups did a pretest quiz and every group distributed in separated classes based on the prior randomization process. Then, every group learned about "Adolescence Health" by external Academic Medical education experts' tutors with the same agenda and contents and followed by the posttest quiz. Both tutors were aware of study objectives, and they confirmed to implement the PBL and LBL educational methods properly as planned. Pretest quiz was carried out to find the variation between interns and give a background about their learning outcomes, performance, attitude, and motivation while posttest quiz to find out the effect of the learning models on the participants. Interns in the PBL group were divided into subgroups and each intern took on a role within the subgroup based on PBL principles. Each subgroup had different resources and materials to search on the internet, retrieving information, discuss and present the findings. The External tutor "rather than study investigators" was facilitated PBL through supporting, guiding, and monitoring PBL educational process. The participants worked independently, searching, and looking for the learning goals and objectives during the tutorials, and then the participants in each subgroup met again and presented their findings. After that, each subgroup submitted a paper summarizing the subject and each intern filled the questionnaire and tested posttest PBL quiz.

In the LBL group, the external tutor presented a lecture about "Adolescent Health" in about 30 minutes followed by filling the questionnaire and posttest LBL quiz. Interns in the PBL group consumed 3 hours compared to one hour in the LBL group. Intern's name and study's group were concealed in all questionnaires and pre-posttests as well as an encrypted code were used during the correction of pre-posttests and data entry. The investigator collected data through a self-created questionnaire and multiple-choice questions (MCQs) pre-posttest quiz in "Adolescent health" after a review of some relevant literatures [4, 6, 14]. They were validated by a revision of two Family Medicine Consultants with Biostatistician and modified accordingly. As well, pilot study was performed on 5 participants in the same hospital. The questionnaire included two sections; section one collected the academic performance, satisfaction with the PBL, preferable

method of learning in post-graduation medical education and the participants' knowledge about the topic of "Adolescence Health". Section two included the attitude toward the educational method that exposed to. The pre-posttest quiz included 20 MCQs in the topic of "Adolescent health".

Collected data were entered into a personal computer and analyzed using (SPSS) software with ensuring data privacy and safety. All variables were coded before entry and checked before analysis. Cross tables with percentages and P-value through Chi-square test were used to compare between PBL and LBL (Table 1-2). As well, score mean difference between pre-posttests and both groups was calculated through Paired T test and Student T test (Table 3-4). Inferential statistics assessed through *P* value of equal or less than 0.05 and 95% confidence interval level which consider the statistically significant result. Study proposal was approved by Saudi commission for health specialties. Study investigator coordinated with Academic Affairs at KAHNG Al Ahsa and King Saud Bin Abdulaziz University for Health Sciences (KSAUHS) Al Ahsa to contact with medical interns and utilize the educational classes to conduct the experiment. All the information kept confidential. All included interns signed the consent form before involving in the study.

3. Results

Table 1 elaborates post-graduation medical education information for medical interns in PBL and LBL groups. The total number of medical interns who participated in the study was 14 in the PBL group and 14 in the LBL group. The academic performance revealed that 6 Interns (60.0%) in the PBL group and 4 Interns (36.3%) in the LBL group had GPA between 3 to 3.9 out of 5 while 40.0% in the PBL group and 63.6% in the LBL group had GPA between 4 to 4.9 (*P*<.4). The satisfaction with PBL as an effective post-graduation medical education method was 57.1% in the PBL group compared to 78.5% in the LBL group (*P*=.4). Furthermore, 64.2% of both groups considered PBL as a better method for post-graduation medical education. In general, there was no significant difference between PBL and LBL groups.

Table 2 measures the attitude of medical interns in PBL and LBL groups toward short course post-graduation educational methods that were exposed in this study. According to interns in the PBL group, it was stimulating (85.7%), ease (35.7%), useful (71.4%), powering (92.8%), and enlightening (71.4%) compared to the LBL group which was (64.2%), (64.2%), (92.8%), (71.4%), and (85.7%) respectively. Table 3 summarizes the comparison between pre and posttest score in PBL and LBL groups. There was no statistical difference between posttest (Mean (SD), 13.85 (3.08)) and pretest (Mean (SD), 12.50 (1.95)) in PBL group (*P*=.09). While in the LBL group, mean difference between post and pretests was (Mean difference (SD) 4.21 (2.42)) which was statistically significant (*P*<.001). Table 4 compares pre and posttest scores between PBL and LBL group. There was no statistically significant difference between PBL and LBL in pretest score (*P*=.93). Although mean posttest score of the PBL group was 13.85 (3.08) compared to LBL group 16.64 (0.64) which was statistically significant (*P*=.01). As well, mean post-pre score was 1.35 (2.76) in PBL group and 4.21 (2.42) in LBL group (*P*=.01).

S.No	Item		PBL n = 14		LBL n = 14		P
			No. (%)		No. (%)		
1	GPA out of 5 (Missed 7)	3-3.9	6	(60.00)	4	(36.36)	0.39
		4-4.9	4	(40.00)	7	(63.64)	
2	Did you attend a course about PBL in medical education?	Yes	12	(85.71)	12	(85.71)	1
		No	2	(14.29)	2	(14.29)	
3	Are you satisfied for PBL as an effective method in post-graduation medical education?	Yes	8	(57.14)	11	(78.57)	0.42
		No	6	(42.86)	3	(21.43)	
4	In your opinion, Which method is better in post-graduation medical educational PBL or LBL?	PBL	9	(64.29)	9	(64.29)	1
		LBL	5	(35.71)	5	(35.71)	
5	Do you have a good updated knowledge in the topic of "Adolescence health"?	Yes	5	(35.71)	6	(42.86)	1
		No	9	(64.29)	8	(57.14)	

Table 1: Distribution of post-graduation medical education information for medical interns in PBL and LBL groups.

	Items	PBL n = 14		LBL n = 14		P
		No.	(%)	No.	(%)	
1	Stimulating	12	(85.71)	9	(64.29)	0.38
	Boring	2	(14.29)	5	(35.71)	
2	Ease	5	(35.71)	9	(64.29)	0.13
	Difficult	9	(64.29)	5	(35.71)	
3	Useful	10	(71.43)	13	(92.86)	0.32
	Waste of time	4	(28.57)	1	(7.14)	
4	Empowering	13	(92.86)	10	(71.43)	0.32
	Disempowering	1	(7.14)	4	(28.57)	
5	Enlightening	10	(71.43)	12	(85.71)	0.64
	Confusing	4	(28.57)	2	(14.29)	

Table 2: Attitude of medical interns in PBL and LBL groups toward the received educational method in this study.

	Post-test		Pretest		Mean Dif.	t	P	95%CI	
	Mean	SD	Mean	SD					
PBL	13.58	3.08	12.50	1.95	1.35	1.83	0.09	-0.23	2.95
LBL	16.64	1.64	12.42	2.47	4.21	6.50	<0.001	2.81	5.61

Table 3: Comparison between pre and post test score of medical short courses post-graduation education among medical interns in PBL group and LBL group.

	PBL		LBL		Mean Dif.	t	P	95%CI	
	Mean	SD	Mean	SD					
Pretest score	12.50	1.95	12.42	2.47	0.07	0.08	0.93	-1.65	1.80
Post-test score	13.85	3.08	16.64	1.64	-2.78	-2.98	0.01	-4.70	-0.86
Post-Pretests score	1.35	2.76	4.21	2.42	-2.85	-2.90	0.01	-4.87	-0.83

Table 4: Comparison between medical interns in PBL group and LBL group in pre and post test score of medical short courses post-graduation education.

4. Discussion

In the current study, post-pretests mean score of the LBL group was about triple more than the PBL score among medical interns in post-graduation medical educational method. It was also analyzed from the responses that satisfaction for PBL as an effective post-graduation medical education method and the attitude toward the educational method did not demonstrate any statistically significant results between both groups. Medical Intern's academic performance, attending a course about PBL in medical education and having good, updated knowledge in the topic of "Adolescence Health" did not show any statistical variation between both groups. From the review of the literature, it was observed that some studies reported that PBL is more effective in learning outcomes than LBL. A study was done at the University of Michigan College of Pharmacy in 2016 reported that team-based learning is an effective learning method compared to lecture format on the learning outcomes [4], while Faisal et al found the medical students of PBL outperformed LBL medical students in academic performance [1].

In addition, a study from Kuwait in 2016 reported that the PBL students performed better than the traditional lecture-based curriculum students in overall grades, theoretical knowledge base and OSCE [5]. It is noticed that PBL teaching model is more effective when applied to laboratory courses than to theory-based courses in undergraduate medical courses in Chinese medical education system based on a systematic review and meta-analysis [15]. Further review of the literature did not reveal significant differences between PBL and LBL. A study was done in Malaysia found the outcome after teaching between PBL and traditional methods did not show a significant difference [9]. Khoshnevisasl et al found that the difference between PBL and LBL in the exam scores was not statistically significant. The participants preferred PBL over LBL because of motivation boost, a higher quality of education, knowledge retention, class attractiveness, and practical use [10]. A study from Hamadan University of Medical Sciences reported that there was more satisfied with the PBL method, increased motivation and enhanced educational activity but there was no relationship between the students' satisfaction and learning progress. The quality of education can be improved through the PBL method [8].

In addition, no statistically significant difference was found between the PBL and LBL in the level of attitude toward learning method but learning motivation was significantly higher in the PBL group [3]. Nandi et al found a combination of both learning

methods that may provide the most effective training for undergraduate medical students. There was no convincing evidence of improved learning using the PBL [14]. Limitations of the study include; (i) sample size was small although it was calculated scientifically. (ii) Study has a narrow question and restricted criteria. (iii) Because study's intervention has a short duration, both intervention and outcome were implemented and detected in the same sitting for both groups.

5. Conclusion

LBL is more effective in the learning outcomes and performance among medical interns in short course duration post-graduation education compared to PBL. The satisfaction, attitude, and motivation toward both methods of learning are equal. Further studies are recommended in this regard to compare PBL and LBL in long course duration post-graduation education on a large number of participants.

Declarations

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Availability of data and materials

Datasets are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Study proposal was approved by the research committee in Saudi commission for health specialties. All the information kept confidential. All included interns signed the consent form before involving in the study.

Conflicts of interest

There are no conflicts of interest.

Author's contributions

Al Joher AL. is study's Principal investigator and first responsible, wrote study proposal and manuscript, supervised of study's intervention implementation, and follow up other tasks. Al Jasem participated in literature review, revised study proposal and manuscript, data entry and assisted the Principal investigator. Al Huwail conducted the literature search for the background of the study. Al Jamaan was the scientific supervisor, analyzed and interpreted statistical data in addition to general review and editing. Al Joher AB. participated in data collection.

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