

RESEARCH ARTICLE

THE PERSPECTIVE OF FIRST YEAR DENTAL STUDENTS TO CASE-BASED LEARNING AS AN EFFECTIVE TOOL IN LEARNING PHYSIOLOGY: A CASE STUDY.

DR Saira Rafique (DHQ Bagh),DR Aamir arif (MBBS mirpur) ,DR Khansa Javed Abbasi (AJKMC),DR Areez Ayoub (MBBS MC mirpur),DR Zuha Yasin (Fatima Jinnah Medical university),DR Hafsa Nosheen (PMC Rawalakot)

Manuscript Info

Manuscript History

Received: 03 June 2026
Final Accepted: 03 June 2026
Published June 05/26

Key words:-

Case-based learning, PBL, Small group teaching, personal skills, professionalism

Abstract

Background: Understanding and recall of human physiology is much easier when it is linked to the real life patient cases. Case-based learning (CBL) is a teaching method where the students are motivated towards self-directed learning and to develop analytic and problem-solving skills.

Aim: The present study aimed to measure dental students' perceptions of introducing small group case-based learning in teaching cardio respiratory physiology.

Methodology: Data were collected from semester one dental students at MAHSA University, Malaysia. Cardio respiratory case-based questions were given to the students after finishing their didactic lectures of cardiovascular and respiratory physiology. 74 students were divided into 9 groups to learn and discuss the case. At the end of the session, a 23 items perception scale was given to the students to measure their acceptance of CBL, impact of CBL on personal skills and impact of CBL on professionalism.

Results: The results showed that the students enjoyed CBL and reported that CBL improved their personal skills and professionalism. There was a positive correlation between CBL acceptance and impact of CBL on personal skills as well as professionalism. The study showed a significant difference in between the small groups in their acceptance of CBL and their opinions on the impact of CBL on the professionalism with insignificant difference in their opinions about the impact of CBL on their personal skills.

In conclusion: CBL helped in understanding and integrating cardiovascular and respiratory physiology, improved the student's personal skills and professionalism.

Introduction:-

Human physiology is seen as an important core component of any medical curriculum [1]. The main objective of the physiology teacher is to make sure that the subject of physiology is easily understood by diverse groups of students belonging to different courses [2]. Learning and remembering human physiology is much easier when you can link it to real life patient cases. A genuine feel for how essential it is to clinical practice is thereby obtained which makes it not only interesting but also understandable. From this point of view emerged the importance of the new learning

strategies such as Problem-Based-Learning (PBL) [3] and Case-Based-Learning (CBL) [4] in teaching physiology for medical students. Conventionally, teaching of undergraduate students is done with the help of didactic lectures, practical's, tutorials, and clinics, which are mostly used as passive teaching and learning methods and mostly they lack in the development of problem solving or reasoning skills of the students. Furthermore, there is hardly any involvement of students in the teaching-learning process [4].

MAHSA University college dental program started in 2007 uses a traditional curriculum where Anatomy, Physiology and Biochemistry are taught along with dental anatomy in the first year of a 5 year program. The teaching learning modalities followed are didactic lectures, tutorials, question based discussions and practical's- both hands on and demonstration. Since this is a traditional subject based curriculum, introducing problem based learning seemed to be difficult with students in their first semester. The physiology department decided to introduce CBL instead of PBL to stress on physiological principles and facilitate proper learning amongst the students.

CBL is a teaching method where students are motivated to learn on their own so as to inculcate the habit of self-learning and integrating knowledge from different subjects [5]. CBL is similar to PBL in the sense that both of the methods are based on the use of a case, problem, or inquiry to stimulate and motivate the students to acquire knowledge [6]. However CBL is different from PBL in the following: first, CBL uses a guided inquiry method in which the facilitator plays an active role however PBL uses an open inquiry method in which the facilitator plays a passive role, second, in CBL, the students are already had the knowledge and CBL motivates them through learning the application of their knowledge, however in PBL the students are motivated to identify what they need to know and learn themselves [7].

The objective of this study was to assess the attitude of the dental students in their first semester towards using an active learning strategy in the form of case based learning and whether it was fruitful in improving their knowledge, skills and attitude.

Methods:-

Design and Procedure:-

This is an observational retrospective study involving 74 students who were admitted in the Doctor of Dental Surgery (DDS) program in 2013.

Institutional Setting:-

MAHSA University College, a relatively new private institution in Kuala Lumpur, Malaysia offers a 5 year Doctor of Dental Surgery [DDS] course. The curriculum requires basic sciences namely Anatomy, Physiology, Biochemistry along with Dental Anatomy to be taught in the first year, followed by preclinical subjects of Microbiology, Pharmacology, Pathology in the second year and subsequently three years of clinical training.

Study format:-

The study was conducted among year one DDS students at MAHSA University College. After students had finished the didactic lectures, tutorials, practical's of the physiology of cardiovascular and respiratory systems, a cardiorespiratory case (Appendix 1) and physiology based questions on the case were prepared by a team of physiologists in the physiology department. The case was formulated in a brief format and framed in a way that matches the student's acquired knowledge that they have been taught in their didactic lecture classes. The questions were discussed in a systematic way and each member of the group had a chance to participate [8].

The 74 students were divided into 9 groups each group contained 8 students and the whole groups were facilitated by two facilitators from the physiology department. The students were given the important instructions of how to handle the CBL session (read the case & questions, discussing on between themselves, using their learning resources and keep their findings ready to be presented at the end of the session).

The role of facilitators was to guide the students, discuss with them the answers, clarifying any doubt and remained as facilitators and not instructors. The total time for supervision was 60 min, and 45 min was the wrap-up discussion presented by all groups; 5 minutes for each group. The facilitators divided the questions in between the groups and asked each group to present their answers for one to two questions.

At the end of the session, the students were given a questionnaire (Appendix 2) to check for their acceptance of the CBL and the ability of this TLA in helping them to improve their knowledge & understanding of the cardiorespiratory physiology, improving their cooperativeness, communication skills and presentation skills.

Research material and Statistics:-

A 23 items- questionnaire was given to the students after the intervention with a response scale of 5 points rated from (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree) were framed in such a way to cover the opinions of students regarding;

- Acceptance of CBL.
- Impact of CBL on their interpersonal, communication and oral presentation skills.
- Impact of CBL on their attitude and professionalism.

The data was analyzed through the Social Sciences (SPSS) program in its version 22 using descriptive statistics for the means and standard deviation for the responses for each item. Statistical significance was decided whenever $p < 0.05$. Simple regression analysis test was used to determine the relationship between the three factors of the CBL scale, Tukey's range test in conjunction with ANOVA were used to find any significant differences in means of the responses of the different groups.

Reliability and factor analysis of the questionnaire- items:-

Reliability which is the best single measure of test accuracy is the extent to which test results are consistent, stable, and free of error variance. It is the extent to which a test provides the same ranking of students when it is readministered, and it is measured by Cronbach's α . Factor analysis, which is the first step in the calculation of α -coefficient, is a data reduction technique used to group various items having homogeneity/unidimensionality [9]. This reduced the twenty three items into three meaningful factorial groups, which were grouped as F1, F2, and F3 under the following headings: acceptance of CBL F1 items 1- 11, perception of the impact of CBL on interpersonal, communication and oral presentation skills F2 items 12- 18, and perception of the impact of CBL on their attitude and professionalism F3 items 19-23. Spearman's rank correlation was calculated to check the interrelation of each item's score with the total score (item interrelatedness) [10]. Cronbach's α reliability coefficient was then calculated. The value normally ranges between 0 and 1. The closer Cronbach's α coefficient to 1.0, the greater the internal consistency of the items in the scale. Interpretation of the value varies according to the number of items. Reliabilities as low as 0.50 are satisfactory for short tests of 10–15 items, but tests with >50 items should have reliabilities of 0.80 or higher. If reliability is <0.8 , a single test score should not be used to make important decisions about individuals [11]. The results for factor analysis of the items are shown in Table 1.

Results:-

The results of the study showed high acceptance of CBL among first year dental students (M of 3.37 and SD of 0.66) and the mostly appreciated was that CBL helped the students to demonstrate constructive and critical thinking process (M of 3.91 and SD of 0.78). The results showed a positive impact of CBL on the skills (Mean of 3.62 with SD of 0.65) especially small group working dynamics (M of 3.79 and SD of 0.83), then searching skills-locating and finding information skills (M of 3.69 and SD of 0.86). Also the figure showed a positive impact of CBL on the student's professionalism (M of 4.07 with SD of 0.75) especially punctuality and attending the discussion (M of 4.19 and SD of 0.93) followed by respect of other students opinions (M of 4.14 and SD of 0.78) (Fig. 1).

The results showed a significant difference between the groups in their acceptance of CBL ($p = 0.020$) and the impact of CBL on attitude & professionalism ($p = 0.021$) done by ANOVA test (Fig. 2). Both were higher in group 6 (TukeyHSD^{a,b} test) with insignificant difference in the impact of CBL on the personal skills ($p = 0.543$). ANOVA also showed insignificant differences within the groups in CBL acceptance, impact of CBL on personal skills and impact of CBL on professionalism (Fig. 2).

CBL acceptance was found to be positively correlated with the impact of CBL on personal skills and professionalism, p - value = 0.00. The simple regression test between the acceptance of CBL as an independent variable and impact of CBL on personal skills, attitude and professionalism as dependent variables showed that acceptance of CBL could predict 52% change in the impact of CBL on the personal skills, adjusted; $R^2 = 0.525$ ($F = 27.458$; $p < 0.001$) and 45% of the impact of CBL on attitude and professionalism with adjusted $R^2 = 0.456$ ($F = 18.865$; $p < 0.001$) (Table. 2)

Discussion:-

Understanding of cardiorespiratory physiology is one of the important human body systems required for dentists. Depending only on a traditional way of teaching through lectures lacks the advantages of motivation, active interaction from the students, triggering of thinking and empowering them with the ability of integrating the knowledge and their application [12]. Learning human physiology through relevant cases has been shown a positive impact on understanding physiology among medical students [3] and to promote a deep learning in dental students [13]. The aim of the current study was to explore the perception of dental students to CBL and whether the method helped in understanding the knowledge about cardiorespiratory physiology and improved the ability to apply these knowledge's and to assess the perception of the students about the effectiveness of CBL in improving the personal skills and professionalism.

The results of this study showed that CBL was interesting, motivated the students to learn by themselves, and helped them in gathering knowledge and application of this knowledge in the understanding the current case. This is in agreement with Yoo *et al.* who examined the effects of CBL on learning motivation in nursing students and found that it was significantly higher in the CBL group than in the non-CBL one [14]. The results showed that CBL helped students to demonstrate constructive and critical thinking process which is in line with Kaddoura who found same effect of CBL in nursing students [15]. This enforces the aim of introducing this type of teaching for dental students.

The results also showed that CBL improved the student's personal skills specially their communication skills which are known to be essential for medical as well as dental doctors [16]. In line with our findings, it has been reported that student communication skills and ability to work within a team were significantly improved due to CBL implementation in a microbiology course [17-18] and pharmacology course [19]. Our data indicated that this innovative pedagogical approach not only improved students' personal skills but also improved students' professionalism in the form of punctuality and respect of others opinions in the group.

The results of this study showed a positive correlation between the acceptances of CBL and the student's opinions about CBL impact on their personal skills and professionalism with higher correlation found with the personal skills. Although the study showed insignificant difference between the individual groups in the impact of CBL on the personal skills there was a significant difference in the acceptance of CBL and their perception about impact of CBL on the professionalism. This can be due to the different personality traits of the students which was found to affect the preference of medical students to problem based learning [20] or any other factors which affect the acceptance of the students of any teaching methods.

Conclusion:-

Teaching human physiology becomes much easier if the students understand its application in their clinical life. This can be achieved by using a relevant case-based learning which will not only help in understanding but empower the students with the critical thinking skills, problem solving skills, communication skills as well as proper attitude and professionalism.

Recommendations:-

Further studies on the effectiveness of CBL in teaching human physiology to be joined with pre and post assessment of the students, personality scales, quality of life and other factors which can affect the effectiveness of CBL as a teaching method

Appendix A: Case – Scenario:-

A 45-year-old man presented at the dental clinic with bleeding gums. After checking the dentist found the gums were healthy but his blood pressure was found to be 160/110 and was equal on both arms and legs. The dentist referred the patient to a physician for assessment. The patient was alert and cooperative but appeared to be anxious. The patient reported that he had been having frequent coughs with sputum production and feels uncomfortable while breathing, which worsen with exertion. He reported that he is a social drinker and smokes 2 packs of cigarettes a day for the past 20 years. He also indicated that he was too busy to exercise. There was a family history of heart disease but no family history of diabetes.

Physical examination showed:-

Vital signs:

Pulse	80/min
Blood pressure	160/110
Temperature	37 ⁰ C
Respiratory rate	15/min
BMI	32

Cardiovascular examination:-

ECG: normal

Heart sounds: normal

Respiratory examination:-

Wheezes were heard on both sides of the chest

The physician referred him to get a pulmonary function test done

Appendix B: Feedback questionnaire about CBL:-

Using 5-point Likert scale (Strongly disagree- Disagree- neither agree or disagree- Agree- Strongly agree)

• Acceptance of CBL:-

1. The case was interesting to me
2. It helped me to demonstrate constructive and critical thinking process
3. CBL helped me to develop better skills of gathering information, organizing it and storing for future use.
4. I believe that CBL will make me capable of applying knowledge to new situations to solve problems and reach decisions
5. CBL method has motivated me to learn
6. CBL method has instilled self-learning skills in me
7. I think CBL method will change my way of learning
8. My overall experience with case-based-learning is satisfactory
9. Though this was the first case study, I understood the pathogenesis of the condition
10. Though this was the first case study, I was able to interpret the investigations done for this patient
11. Though this was the first case study, I was able to understand the case and answer the questions given

• CBL and personal skills:-

12. I was able to participate in the group discussions and activities
13. I liked the small group working dynamics
14. I find that I am discussing with other students more than usual
15. I feel CBL will help me improve my communication skills
16. I think CBL will improve my oral presentation skills
17. I think CBL will improve my searching skills-locating and finding information
18. I think CBL will improve my skill of comprehension, express my views in my own words

• CBL and professionalism:-

19. I was punctual and attended the discussion
20. While doing this case study, I showed responsibility and commitment in the group activity
21. I learnt to respect other student's opinions
22. CBL method has developed positive attitudes providing and accepting constructive feedback
23. I became more perceptive and sensitive to the needs of others during group work-contribute to group harmony, listening to conflicting opinions, tolerating shortcomings of others.

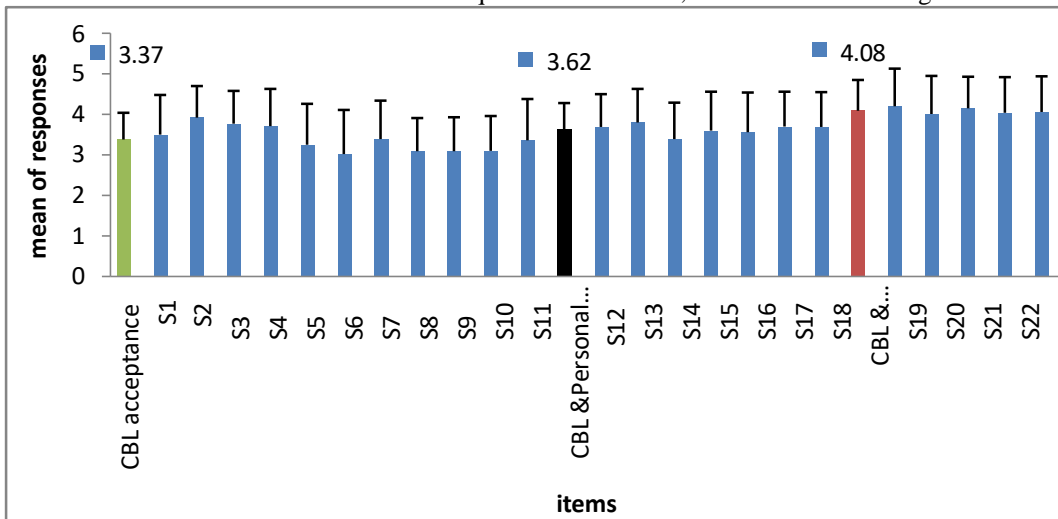
Acknowledgements:-

Authors express their appreciation to first-year dental students for their cooperation, physiology department and faculty of medicine at MAHSA University, Malaysia for providing support and the resources required.

Disclosures:-

The authors declare no conflicts of interest

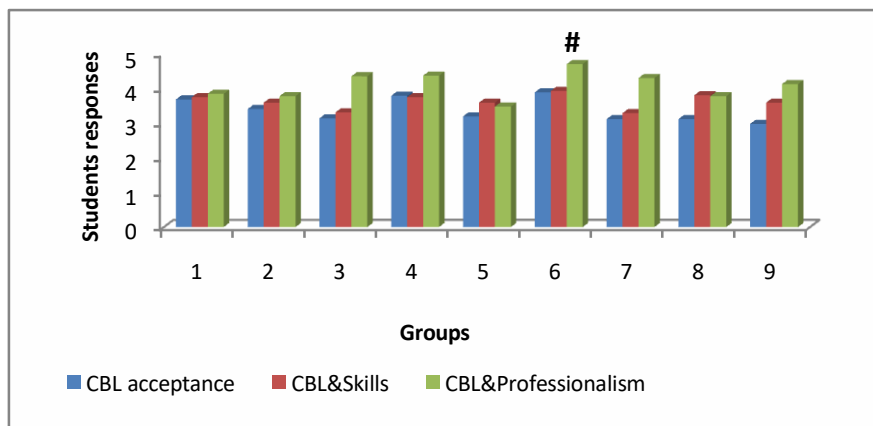
Figure 1:-Bar chart showing means with error bars of the responses of 74 students for the three factors of CBL scale and the individual items of the questionnaire. CBL, Case-Based- Learning



CBL. Case Based Learning, S1. The case was interesting to me, S2. CBL helped me to demonstrate constructive and critical thinking process, S3.CBL helped me to develop better skills of gathering information, organizing it and storing for future use., S4.I believe that CBL will make me capable of applying knowledge to new situations to solve problems and reach decisions,S5.CBL method has motivated me to learn, S6. CBL method has instilled self-learning skills in me, S7.I think CBL method will change my way of learning, S8. My overall experience with case-based-learning is satisfactory, S9.I understood the pathogenesis of the condition S10.I was able to interpret the investigations done for this patient, S11.I was able to understand the case and answer the questions given, S12.I was able to participate in the group discussions and activities, S13.I liked the small group working dynamics, S14. I find that I am discussing with other students more than usual, S15. I feel CBL will help me improve my communication skills; S16.I think CBL will improve my oral presentation skills, S17. I think CBL will improve my searching skills-locating and finding information, S18. I think CBL will improve my skill of comprehension, express my views in my own words, S19.I was punctual and attended the discussion, S20. While doing this case study, I showed responsibility and commitment in the group activity, S21. I learnt to respect other students opinions, S22.CBL method has developed positive attitudes providing and accepting constructive feedback and S23.I became more perceptive and sensitive to the needs of others during group work-contribute to group harmony, listening to conflicting opinions, tolerating shortcomings of others.

Data are presented as mean ± SD

Figure 2:-Bar chart showing the means of the responses of individual groups of the students to CBL acceptance, impact of CBL on personal skills and impact of CBL on attitude and professionalism. CBL, Case-Based- Learning



CBL, Case-Based- Learning

Significant difference from other groups with p value < 0.05

Table 1:-Factor analysis of items related to CBL from survey*(N=74)

		F1	F2	F3
1.	The case was interesting to me	.675		
2.	It helped me to demonstrate constructive and critical thinking process	.663		
3.	CBL helped me to develop better skills of gathering information, organizing it and storing for future use.	.735		
4.	I believe that CBL will make me capable of applying knowledge to new situations to solve problems and reach decisions	.608		
5.	CBL method has motivated me to learn	.757		
6.	CBL method has instilled self-learning skills in me	.571		
7.	I think CBL method will change my way of learning	.660		
8.	My overall experience with case-based-learning is satisfactory	.663		
9.	Though this was the first case study, I understood the pathogenesis of the condition	.737		
10.	Though this was the first case study, I was able to interpret the investigations done for this patient	.768		
11.	Though this was the first case study, I was able to understand the case and answer the questions given	.506		
12.	I was able to participate in the group discussions and activities		.664	
13.	I liked the small group working dynamics		.723	
14.	I find that I am discussing with other students more than usual		.554	
15.	I feel CBL will help me improve my communication skills		.762	
16.	I think CBL will improve my oral presentation skills		.817	
17.	I think CBL will improve my searching skills-locating and finding information		.590	
18.	I think CBL will improve my skill of comprehension, express my views in my own words		.664	
19.	I was punctual and attended the discussion			.764
20.	While doing this case study, I showed responsibility and commitment in the group activity			.799
21.	I learnt to respect other students opinions			.842
22.	CBL method has developed positive attitudes providing and accepting constructive feedback			.817
23.	I became more perceptive and sensitive to the needs of others during group work-contribute to group harmony, listening to conflicting opinions, tolerating shortcomings of others.			.830
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.861	.777	.834
Sig		.000	.000	.000

*Factor structure with Principal Component Extraction with Varimax rotation: 23 items of CBL scale. F1 interpreted as CBL acceptance items emerged as the first extracted factor. F2 interpreted as CBL impact on the personal skills items was the second extracted factor. F3 interpreted as CBL impact on the professionalism and attitude items was the third extracted factor. Correlations with the latent extracted factors below 0.45 were not reported. The total scale captured 80.7% of total variance.

Table 2:-Impact of CBL on personal skills and professionalism as dependent variables in simple linear regression analysis with CBL acceptance as one block of independent variable

One block of independent variable	Personal skills			Professionalism		
	B (Standardized Coefficients)	t	P-value	B (Standardized Coefficients)	t	P-value
CBL acceptance	.525	5.479	.000	.456	5.602	.000
		5.240	.000		4.343	.000
R ²	.525 ^a			.456 ^a		
F	27.458		.000	18.865		.000
df	1			1		

CBL: Case based learning;R² is square R which means the strength of relationship between the independent and dependent variables.

References:-

1. West JB. Thoughts on teaching physiology to medical students in 2002. *Physiologist, Physiologist*. 2002; 45(5):389, 391-3.
2. Rajaratnam N, Suganthi V, D'cruz SM. Learning preferences of students studying Physiology in South India. *IOSR-JDMS*. 2013; 7(1): 15-19.
3. Mierson S. A problem-based learning course in physiology for undergraduate and graduate basic science students. *Am J Physiol*. 1998; 275(6 Pt 2):S16-27.
4. Gade S, Chari S. Case-based learning in endocrine physiology: an approach toward self-directed learning and the development of soft skills in medical students. *AdvPhysiol Educ*. 2013; 37(4):356-60.
5. Srinivasan M, Wilkes M, Stevenson F, Nguyen T, Slavin S. Comparing problem-based learning with case-based learning: effects of a major curricular shift at two institutions. *Acad Med*. 2007; 82(1):74-82.
6. Schmidt HG, Rotgans JI, Yew EH. The process of problem-based learning: what works and why. *Med Educ*. 2011; 45(8):792-806.
7. Setia S, BobbyZ, Ananthanarayanan PH, Radhika MR, Kavitha M. Case Based Learning versus Problem Based Learning: A Direct Comparison from First Year Medical Students Perspective. *WebmedCentral MEDICAL EDUCATION*. 2011; 2(6):WMC001976.
8. Mpofo DJ, Das M, Murdoch JC, Lanphear JH. Effectiveness of problems used in problem-based learning. *Med Educ*. 1997; 31(5):330-4.
9. Ghosh S. Combination of didactic lectures and case-oriented problem-solving tutorials toward better learning: perceptions of students from a conventional medical curriculum. *AdvPhysiol Educ*. 2007; 31(2):193-7.
10. Streiner D. Starting at the beginning: an introduction to coefficient alpha and internal consistency. *J Pers Assess*. 2003; 80(1):99-103.
11. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *IJME*. 2011; 2: 53-55.
12. McCowan RJ, McCowan CS. *Item Analysis for Criterion Referenced Tests* (monograph). Buffalo, NY: Centre for Development of Human Services, 1999; 3-11.
13. Sprawls P. Evolving models for medical physics education and training: a global perspective. *Biomed Imaging Interv J*. 2008; 4(1):e16.
14. Ilgüy M, Ilgüy D, Fişekçioğlu E, Oktay I. Comparison of case-based and lecture-based learning in dental education using the SOLO taxonomy. *J Dent Educ*. 2014; 78(11):1521-7.
15. Yoo MS, Park JH, Lee SR. The effects of case-based learning using video on clinical decision making and learning motivation in undergraduate nursing students. *J Korean AcadNurs*. 2010; 40(6):863-71.
16. Kaddoura MA. Critical Thinking Skills of Nursing Students in Lecture-Based Teaching and Case-Based Learning. *International Journal for the Scholarship of Teaching and Learning*, 2011; 5: (2), Article 20.
17. Hurwitz S, Kelly B, Powis D, Smyth R, Lewin, T. The desirable qualities of future doctors--a study of medical student perceptions. *Med Teach*. 2013; 35(7):e1332-9.
18. Ciraj AM, Vinod P, Ramnarayan K. Enhancing active learning in microbiology through case-based learning: Experiences from an Indian medical school. *Indian J PatholMicrobiol*. 2010; 53(4):729-33.
19. Blewett EL, Kisamore JL. Evaluation of an interactive, case-based review session in teaching medical microbiology. *BMC Med Educ*. 2009; 27; 9:56.
20. Tayem Y. The Impact of Small Group Case-based Learning on Traditional Pharmacology Teaching. *Sultan Qaboos Univ Med J*. 2013; 13(1):115-20.
21. Holen A, Manandhar K, Pant DS, Karmacharya BM, Olson LM, Koju R, Mansur DI. Medical students' preferences for problem-based learning in relation to culture and personality: a multicultural study. *Int J Med Educ*. 2015; 19; 6:84-92.