Strides Dev Med Educ. 2022 December; 19(1):123-129. doi 10.22062/sdme.2022.197298.1100

Original Article

Survey of Medical Students of Regarding the Effectiveness of the Implemented Program of Theoretical Courses of Skin Diseases based on the PBL Method

Davoud Tahmasebzadeh Sheikhlar[1], Farnaz Limouei[2*], Mohammad Reza Ranjkesh[3], Armaghan Gharaaghaji-Zare[4], Afsaneh Radmehr[4]

[1]Associate Professor, Department of Educational Sciences, Faculty of Educational Sciences and Psychology, University of Tabriz, Tabriz, Iran
[2]PhD Student, Department of Educational Sciences, Faculty of Educational Sciences and Psychology, University of Tabriz, Tabriz, Iran
[3]Associate Professor, Department of Dermatology, Faculty of Medical, Tabriz University of Medical Sciences, Tabriz, Iran
[4]Assistant Professor, Department of Dermatology, Faculty of Medical, Tabriz University of Medical Sciences, Tabriz, Iran

Received: 2022 March 06
Revised: 2022 September 04
Accepted: 2022 September 26
Published online: 2022 October 08

***Corresponding author:**
Department of Educational Sciences, Faculty of Educational Sciences and Psychology, University of Tabriz, Tabriz, Iran.
Email: limouei.f@tabrizu.ac.ir

Citation:
Tahmasebzadeh Sheikhlar D, Limouei F, Ranjkesh MR, Gharaaghaji Zare A, Radmehr A. Survey of Medical Students of Regarding the Effectiveness of the Implemented Program of Theoretical Courses of Skin Diseases based on the PBL Method. Strides Dev Med Educ. 2022 December; 19(1):123-129. doi:10.22062/sdme.2022.197298.1100

Abstract

Background: Problem-based learning (PBL) has been one of the most attractive and effective teaching-learning programs during the last 40 years and is one of the newest methods of medical education. In this method, students usually work on a problem in small groups and learn the objectives of education, which include basic and clinical knowledge. The purpose of this study was to seek the opinions of dermatology department students about a viral skin diseases course delivered in a PBL style.

Objectives: The purpose of this study was to seek the opinions of dermatology department students about a viral skin diseases course delivered in a PBL style.

Methods: This survey-type cross-sectional collected the opinions of 175 medical students (99 externs and 76 interns) at the dermatology department of Sinai Educational, Research and Treatment Center from April to July 2022. In this study, a researcher-made questionnaire with 25 questions that evaluated learning of viral skin diseases through the PBL method was utilized for data collection. The validity of the questionnaire was confirmed by experts.

Results: The collected opinions of the students showed that this teaching method improved their learning attitude and performance, developed critical thinking skills, improved their ability to learn interactive communication and self-evaluation, and enhanced their time management capacities and motivation to learn clinical subjects.

Conclusion: According to the results, the PBL method is effective in teaching theoretical courses on skin diseases, and this method can be recommended for delivering other similar courses.

Keywords: Problem-Based Learning , Teaching, Theoretical Courses, Viral Skin Diseases

Background

One of the challenges of traditional education is the inability of students to apply scientific information in real conditions and perform their professional duties. Researchers believe that teachers should evaluate the existing teaching methods and create more effective alternatives to improve student's knowledge and skills (1). In medical education, considering the technological advances and the unprecedented growth in medical information and basic medical sciences, there is a need for change (2).

After a while, students may forget what they have learned in traditional models because they are not given the opportunity to think, which is essential in learning (3). For this reason, experts in education and training sciences propose another method known as Problem-Based Learning (PBL), which has been widely used by several universities in different countries (4). In this method, a practical and clinical situation is presented to learners. This model is intended as a stimulus to obtain necessary information about that problem and provide solutions (2).

Copyright © 2022, Strides in Development of Medical Education is Published by Kerman University of Medical Science. This is an openaccess article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/) which permits copy and redistribute the material just in noncommercial usages, provided the original work is properly cited.

Due to the complex nature of some topics, students need to share their current knowledge, discuss proposed ideas, search for information, and develop fundamental discussions to test their proposed solutions (5). Therefore, PBL is an inclusive educational technique in which students learn science through the experience gained from interacting with one another on a topic through discussion (6).

Problem-Based Learning has become increasingly common in curriculum design in medicine, among many other disciplines (7). The first progress in problem-based learning was made in the 1950s at the medical college of Western University in the United States. Subsequently, in 1969, at the medical school of McMaster University in Canada, a new educational model called problem-based learning (PBL) was developed in which the neurologist Howard Barrows made the revolutionary decision to implement the PBL method in the department of neurology. He described the PBL method as a process with seven steps, including explicit expression of terms, defining problems, brainstorming, forming structures and hypotheses, setting learning objectives, studying, and independent, which in short, would evaluate students' knowledge and determine what they should know, and how and where to access new information required for problem-solving. In 1984, following the publication of the report of the Panel on Preparatory Medical College (from the Association of American Medical Colleges) for the general education of the medical profession, the importance of self-directed and problem-based learning was highlighted. In the late 1990s, this method was spread to the Pacific region, especially Australia and China, and was used in medical applications (8). Since then, this new medical education teaching model has gained global prominence. The PBL method is currently used in the education of medical students in many countries, including Australia, Sweden, the Netherlands, and England (1).

Objectives

Several studies have demonstrated that learning through problem-solving method has significant advantages for clinical students over the traditional methods, such as improving the attitude and performance of learning (3), developing critical thinking (9, 10), improving the ability to learn two-way communication and self-evaluation (10), optimal use of clinical training time (11) and motivation to learn clinical and applied topics (12). In a study in 2000, Nandi and her colleagues compared problem-based learning with traditional teaching methods in medical education and evaluated the variables of the educational process, program evaluation, academic progress, and the attitude of students and professors towards the course. The outcomes of this research confirmed the superiority of PBL over other conventional methods (13). In a research conducted by Kermaniyan and his colleagues in 2007, which compared the PBL method with the traditional lecturing method in medical courses, the use of this method resulted in increased participation of the students in the educational activities. It enhanced learning and deep understanding of the material, which, in turn, caused the content to be memorized in the students' long-term memory (14).

Although many studies in recent years have declared the PBL method as effective compared to other traditional methods in medical and other sciences, traditional methods have been dominant in medical sciences education (14). With the circumstances of the COVID-19 pandemic and the barriers to using traditional lecture teacher-centered methods in education, it seems that by identifying and designing the components of the problem-oriented curriculum, great assistance can be offered in the education and academic progress of medical students. Therefore, in this research, we aimed to use the PBL method on one of the critical topics of skin diseases (viral skin disease), where most students have difficulty diagnosing and managing the related disease.

After completing the training course, the students' opinions were sought.

Methods

The nature of this research was practical and quantitative in terms of its purposes. In this study, 175 medical students (99 externs and 76 interns) who were allocated to the dermatology of Sina- Educational, Research and Therapeutic Center of Tabriz University of Medical Sciences participated from April to July 2022. In each training course, a training session on viral skin diseases was assigned to each group of the students.

At the end of the training course, the students were surveyed regarding the PBL teaching method and its impact on their learning. Each training course lasted one month for the externs and two weeks for the interns. For the survey, a researcher-made questionnaire containing 25 questions was used. Standard PBL Works questions from the Buck Institute for Education were used in designing this questionnaire. The validity of the questionnaire was confirmed by professors of the Faculty of Educational Sciences at Tabriz University and professors of the Department of Dermatology Tabriz University of Medical Sciences.

To obtain the results, the following steps were taken:

Collecting and organizing students' opinions on the subject, specifying the main topics, examining ideas, extracting and recording information, analyzing the extracted data, and concluding and summarizing. The frequency of each of the questions was considered to determine its importance.

The PBL implementation process is performed in 7 steps in the classroom:

Step 1: Explicit expression of unfamiliar terms

The professor provides titles and basic information about viral skin diseases and patient treatment information.

Step 2: Problem definition and goal setting

By showing a slide of the skin lesions of the disease, the professor asks the medical students to discuss the diagnosis, differential diagnoses, cause of the disease, duration of treatment, and common prescription drugs based on the essential explanations given and their previous experiences and hypotheses.

For example, the professor shows a picture of a skin lesion and asks students to guess the type of lesion.

Step 3: Data collection

Medical students make hypotheses based on the professor's initial explanations and previous background information. They also collected information regarding the questions that were asked of the professor.

For example, medical students ask the professor about a patient's gender, job, history, the duration of the disease, number and size of lesions, sites involved, the color of lesions, patient occupation, age of the patient, co-morbidities, pathological information of the patient, etc.

Step 4: Brainstorming

In this way, the medical student collects random or selected information based on the assumptions made by other students. The students also benefit from each other's knowledge by listening to questions, answers, and hypotheses. Students sometimes have different views about issues, but all opinions are considered and discussed.

Finally, the professor provides necessary information that medical students may have failed to ask.

Step 5: Structure, teaching, and learning goals, and organization of the collected information

Medical students organize the collected information and information that is approved by the professor.

The information gathered on learning objectives is agreed upon. After discovering the stages of diagnosis and treatment, the professor gives a general summary and overview of the disease. They then give students the opportunity to point out the scientific shortcomings that have impaired their ability to understand the problem. Clear articulation of academic deficiencies prepares the student for independent study activities.

Step 6: Independent study

All medical students collect and record information about each learning goal. After discussing each image, the teacher allows the students to look at the photos of the patients that will be displayed on the following slides. Based on the discussions in the previous educational slides, they state the possible diagnoses, suggested treatments, and their reasons.

At this stage, the professor shows medical students the same educational slides before the lesson begins. The expectations are quite clear, which helps the students to orient their work knowing the goals.

Step 7: Evaluate

In the end, the professor can evaluate students' abilities individually or by dividing them into small groups. In this manner, the professor can determine the amount of learning. At this stage, the medical students discuss each presented slide as a problem. Because this experience allows the issue to be reconsidered, the students will be able to test their ability to deal with the diseases concerned.

Results

The statistical population studied in this study were 175 medical students who were introduced to the dermatology department of Sinai Educational and Medical Center from April to July 2022.

After teaching viral skin diseases in PBL style, the following information was obtained from 175 participating students according to Table 1.

Before attending the viral skin diseases class, all students knew about the "problem-based learning" method. In addition, they were aware of the prerequisite background information.

96% of the students said the topic presented by the professor was in line with the educational curriculum designed by the Ministry of Health. 96.6% of the students found the initial explanations and objectives presented at the beginning of the session by the professor sufficient and valuable. Moreover, 96.6% of the students considered the number of diseases discussed during the training session sufficient. 94.9% of the students mentioned that the questions and answers exchanged between the professor and the students were useful. 94.9% of the students considered the introduced sources sufficient for studying. 96% of the students mentioned their background information as adequate and valuable in intergroup discussions. 97.1% of the students said the PBL teaching method was a new, passionate and motivating method. 92.6% of the students said that intergroup discussions had made

the knowledge meaningful and stable, and as a result, led to deep learning and were more lasting in their memory. 91.4% considered intergroup discussions to be the basis for realizing learning goals.

95.4% of the students believed that this method had increased the ability of cooperation and teamwork among students. 96% of the students said intergroup communication enhanced their clinical thinking. 94.3% considered intergroup communication effective in increasing communication skills.

For 95.4% of the students, intergroup communication had increased their problem-solving abilities, and 99.4% thought the PBL method was effective in improving students' knowledge and awareness, accuracy, concentration, and logical thinking. 98.9% believed that the PBL method strengthened their confidence in expressing their opinions about diseases. As a result, they considered the role of the working group to be effective in increasing their confidence. 98.3% stated that this method allowed them to think about what and how they learned.

Table 1. The degree of satisfaction of students after the teaching of viral skin diseases by the PBL method

Questions related to teaching with the PBL method	Persons		
	Yes	No	To some degree
Is the presented subject consistent with the educational curriculum approved by the Ministry of Health?	168	0	7
Were the initial explanations and objectives provided by the professor at the beginning of the session sufficient?	169	1	5
Was the number of diseases discussed during the training session sufficient?	169	2	4
Were the questions and answers exchanged between professors and students sufficient?	166	3	6
Were the recommended sources sufficient?	166	2	7
Was the background information you had sufficient and valuable in group discussions?	168	2	5
Did intergroup discussions create an internal motivation to learn in you?	170	0	5
Did intergroup discussions make your knowledge meaningful and stable?	162	0	13
Did inter-group discussions make you realize your learning goals?	160	2	13
Were the proportions of the duration of intergroup discussions sufficient and valuable?	65	74	36
Were the proportions of the duration of discussions between professors and students sufficient and valuable?	128	40	7
Did cooperation and teamwork increase your ability to solve problems?	167	3	5
Did intergroup communication among students increase clinical thinking?	168	2	5
Did intergroup communication among students improve communication skills?	165	5	5
Did intergroup communications among the students increase their problem-solving abilities?	167	3	5
Was the PBL method effective in increasing students' knowledge and awareness, accuracy, concentration, and logical thinking?	174	0	1
Did PBL teaching strengthen the confidence of the students to express their opinions about diseases?	173	0	2
Did the method provide opportunities for students to think about what and how they are learning?	172	0	3
Did this method create a close relationship between the students and the professors?	165	3	7
Did the group activity created by the PBL method change the atmosphere of the class from boring to passionate and cheerful?	170	2	3
Was it easier to understand difficult, complex, and elusive topics in diagnosing diseases through the PBL method?	167	2	6
Did the self-assessments during training create a sense of empowerment and increased self-confidence in diagnosing and treating diseases?	171	2	2
Did this method create opportunities for students to provide and receive feedback on their opinions to reconsider their ideas?	168	3	4
Was the participation rate of withdrawn and isolated students increased with this method?	142	21	12
Do you think this method can be effective for teaching other subjects as well?	169	1	5

94.3% of the students considered this method effective in creating a close relationship between the students and the professor. 97.1% of the students said that the group activity component of the PBL method changed the atmosphere of the class from tedious to passionate, enthusiastic, and cheerful. 95.4% of the students believed that understanding difficult, complex, and hard-to-understand topics in diagnosing diseases became more understandable in the PBL teaching method. 97.7% of the students considered the self-evaluations during the training very effective because it made them feel capable of diagnosing and treating diseases.

96% of the students stated that this method created opportunities for them to revise and learn the correct answer by receiving feedback on their answers. 81.1% of the students considered this method suitable for reclusive and isolated students. 12% of the students believed that the withdrawn students were still less talkative and inactive without the teachers' interventions, and 6.9% thought that this method was relatively effective in motivating such students.

96% of the students found this teaching method effective for teaching other skin diseases courses and requested implementation.

Among the concerns and criticisms made by the students, the long discussions between the students can be mentioned. 37.1% of the students considered the duration of intergroup discussions appropriate, 42.3% of the students mentioned that this duration was long and inappropriate, and 20.6% considered it to be relatively appropriate but believed that with timely interventions of the professors, the discussions could be controlled and necessary precautions could be taken to prevent them from going astray. 73.1% of the students were satisfied with the duration of the discussions between the professor and the students, 22.9% mentioned that it was inappropriate, and 4% considered this time relatively appropriate.

Discussion

Today, all countries and nations with any kind of advanced or developing political and social systems pay special attention to the issue of educational planning and reforms based on the latest academic, technical, and scientific methods in the world. This attention is comprehensive and universal and has priority over other initiatives (15). Most universities in the world seek to find educational methods that can expand and improve students' clinical decision-making capacities and self-centered learning (3). Students often forget the material they learn through traditional methods after a while because they are not given the opportunity to think, which is essential in learning (3). For this reason, experts in education science proposed another method called problem-based learning (PBL), which has been used by many universities in different countries in recent years (4). For many years, the traditional method of professor's lectures has been continued for teaching theoretical courses in medical sciences (16). The present study aimed to introduce the theoretical courses of skin diseases using the PBL method and seek the opinions of medical students of Tabriz University of Medical Sciences about this method. The findings of this study showed that PBL was effective in increasing students' knowledge and awareness, accuracy, concentration, and logical thinking, which is in line with the studies of Rasouli (2017), Kermaniyan (2008) and Jabari (2012), who showed that learning through the problem-solving method in comparison with learning through lectures significantly increased the knowledge of nursing and medical students (14, 17, 18). Kermaniyan has stated that in the learning method based on problem-solving, students are more guided toward thinking and avoid memorizing the material (14). The results of studies abroad have also confirmed that the problem-based learning method can be very effective in improving learning. In a study in 2009 by Kocaman, it was found that this method made course subjects more interesting for students, and authors believed that the permanence of acquired knowledge increased (19). Chakravarthi's study in 2010 showed that this method improved learning through understanding the relationship between basic scientific concepts and medical expertise (20). Among the research focused on the present research results, we can mention the Meo study in 2014 (21). The studies of Niwa and his colleagues in 2016 also showed that applying a learning method based on problem-solving for two years can lead to prominent academic achievements for medical students. Improving academic achievement scores in basic and clinical sciences and increasing the amount of medical licensing were among the accomplishments of this study (22). In 2017, Marques investigated the effects of the PBL method focusing on clinical cases in a study. This method was implemented from 2012 to 2015 during each semester for the pathophysiology course of second-year nursing students in a Portuguese college. Since 2012, excellent results have been recorded. A high satisfaction level following students' personal learning was evaluated through an online questionnaire (23).

Our study also showed that problem-centered curricula and teaching methods, in addition to having theoretical support, have advantages in adapting the learners' resources, society, and course subjects, including creating internal motivation for learning, the meaningfulness and stability of knowledge, the realization of learning goals and the transfer of better learning, which is in line with Rasouli's studies in 2017. In Rasouli's study, the effect of two lectures and PBL methods on improving the knowledge of digestion and the performance of the examination of the digestive system, PBL, as an active teaching-learning method, was able to gain a significant advantage over lectures. According to the results of this study, PBL was shown to be more effective than lectures in improving awareness and performance (17).

In the present study, based on the intergroup communication of students regarding gathering information, giving information, and drawing conclusions from communication, it may be claimed that PBL was superior in terms of cooperation, clinical thinking, communication skills, and problem-solving, which is in line with Panjehpour's study in 2012 (24) and Peng's survey in 2021 (25). In the study of Panjehpour's and her colleagues, the use of the PBL method was

reported to be effective in creating and increasing motivation and interest among the biochemistry students, and its deeper learning effects was demonstrated (24). In their study of using virtual simulation with PBL learning for pediatric medical students in 2021, Peng and colleagues showed that students' mastery of pediatric knowledge (initiating communication, gathering information, giving information, understanding pediatric patients, and drawing conclusions from communication) in the study group was significantly higher than the control group (25).

In our study, the students proposed implementation of the PBL method in learning other courses as well similar to HajiBabaee's study in 2019, which, based on the surveys conducted, indicated the effectiveness of the PBL learning method in nursing education and empowering students, and demanded its widespread acceptance and use in the education of nursing students, who expressed their satisfaction of this method (26).

Moreover, among the general skills and attitudes obtained in the present study, we can mention teamwork ability, acceptance of criticism, group leadership, self-directed learning and use of resources, listening, presentation skills, summarizing content, participation, and respect for others' opinions. It is consistent with the studies of Wood in 2003 (27).

Conclusion

The main explanation for the effectiveness of problem-based learning may be the notion that this type of learning depends on various principles of active learning, principles such as cooperation, feedback, and adaptation to students' learning preferences. Problem-centered curricula and teaching methods, in addition to theoretical support, have the advantages of adapting the learner's resources, the community, and the subjects, including creating internal motivation for learning, meaningfulness, and stability of knowledge, logical thinking, the realization of learning goals and better knowledge transfer. Problem-based learning assists students in learning the subject's basic principles in a context that highlights the need to solve problems. During problem-based learning, learners have the opportunity to practice, apply what they have learned, and use the processes of problem-solving skills, interpersonal communication, group formation, self-evaluation, the ability to adapt to change, etc. In addition, problem-based learning can be used in all subjects taught in classrooms.

Create effective PBL scenarios

- Problems should be appropriate to the stage of the curriculum and the levels of the student's understanding
- Scenarios should have sufficient intrinsic interest for the students or relevance in future practice
- Basic science should be presented in the context of a clinical scenario to encourage the integration of knowledge
- Scenarios should contain cues to stimulate discussion and encourage students to seek explanations for the presented issues.
- The problem should be sufficiently open so that discussion is not curtailed too early in the process.

Disadvantages of PBL

From the concerns and criticisms made by the students, we can mention the lengthy discussions between the students. In this study, only a few students considered the duration of intergroup discussions appropriate. Still, with the timely intervention of the professor, the discussions could be managed, and the necessary measure could be taken to prevent them from going astray.

Acknowledgements: Hereby, the researcher and her colleagues express their gratitude to the respected professors of the Department of Dermatology of Tabriz University of Medical Sciences and the students who made this study possible by participating in the research.

Conflict of interests: The authors declared no conflict of interest in this study.

Ethical approval: This study was a joint plan between the Department of Educational Sciences, Faculty of Educational Sciences and Psychology, University of Tabriz and Dermatology Department, Faculty of Medicine, Tabriz University of Medical Sciences.

Ethics committee reference number: IR.TBZMED.REC.1400.1041.

Funding/Support: Medical Education Research Center Tabriz University of Medical Sciences.

References

1. Carey L, Whittaker KA. Experiences of problem-based learning: issues for community specialist practitioner students. Nurse Educ Today. 2002 Nov;22(8):661-8. doi: 10.1016/s0260-6917(02)00109-0. [PMID: 12443703]
2. Memarian R. Problem- Based Learning in Medical Education (P.B.L). Hayat. 1999; 5(3): 47-54. [In Persian]
3. Hasanpour Dehkordi A, Kheyri S, Shahrani M. The effect of teaching using, problem base learning and lecture on behavior, attitude and learning of nursing (BSC) students. Journal of Shahrekord University of Medical Sciences. 2006; 8(3): 76-82. [In Persian]
4. Hilgard ER. Perspectives on educational psychology. Educational Psychology Review. 1996; 8(4): 419-31.
5. Dastgeer G, Afzal MT. Improving English writing skill: A case of

problem based learning. American Journal of Educational Research. 2015. 3(10): 1315-9.
6. Savery JR, Overview of problem-based learning: Definitions and distinctions. In: Walker A, et al. Essential readings in problem-based learning: Exploring and extending the legacy of Howard S. Barrows. west Lafayette: Indiana Purdue University Press; 2015: 5-15.
7. Lonka K. How to Implement an Innovative Problem-Based Curriculum in Medical Education: Challenges and Solutions. In: Fishman BJ, O'Connor-Divelbiss SF. International Conference of the Learning Sciences. New York: Psychology Press; 2009. doi: 10.4324/9780203763865.
8. Hmelo-Silver CE. International perspectives on problem-based learning: Contexts, cultures, challenges, and adaptations. Interdisciplinary Journal of Problem-Based Learning. 2012; 6(1): 10-5. doi:10.7771/1541-5015.1310.
9. Hemmati Maslak Pak M, Orujlu S, Khalkhali H. The effect of problem-based learning training on nursing students' critical thinking skills. Journal of Medical Education and Development. 2014; 9(1): 24-33.
10. Ääri RL, Elomaa L, Ylönen M, Saarikoski M. Problem-based learning in clinical practice: Employment and education as development partners. Nurse Educ Pract. 2008 Nov;8(6):420-7. doi: 10.1016/j.nepr.2007.10.005. [PMID: 18949857]
11. Staun M, Bergström B, Wadensten B. Evaluation of a PBL strategy in clinical supervision of nursing students: Patient-centred training in student-dedicated treatment rooms. Nurse Educ Today. 2010 Oct;30(7):631-7. doi: 10.1016/j.nedt.2009.12.013. [PMID: 20061069]
12. Dadgari A, Dadvar L, Yousefi M. Application of Modified Problem Based-Learning (mpbl)and Students' point of view. Journal of Knowledge & Health in Basic Medical Sciences. 2008; 3(2): 19-25. [In Persian]
13. Nandi PL, Chan JN, Chan CP, Chan P, Chan LP. Undergraduate medical education: comparison of problem-based learning and conventional teaching. Hong Kong Med J. 2000 Sep;6(3):301-6. [PMID: 11025850]
14. Kermaniyan F, Mehdizadeh M, Iravani S, MArkazi Moghadam N, Shayan S. Comparing Lecture and Problem-based Learning Methods in Teaching Limb Anatomy to First Year Medical Students. Iran J Med Educ. 2008; 7(2): 379-88. [In Persian]
15. Delangizan S, Sepah PM, Farshadiyan MM. Advantages and disadvantages of problem-based learning approach as compared to the traditional curriculums from the viewpoint of vocational trainers working in the technical and vocational centers in Kermanshah. Journal of Skill Training. 2013; 1(4): 57-71.
16. Mahram M, Mahram B, Mousavinasab SN. Comparison between the Effect of Teaching through StudentBased Group Discussion and Lecture on Learning in Medical Students. Strides Dev Med Educ. 2009; 5(2): 71-9. [In Persian]
17. Rasouli M, Rasouli A, Kalhor N. Comparing Lecture and Problem-based Learning Methods in Teaching Gastrointestinal Part of Patients' Health Assessment on Nursing Students' Knowledge and Their Performance. Journal of Nursing Education. 2018; 6(5): 25-31. [In Persian]
18. Jabbari H, Bakhshian F, Alizadeh M, Alikhah H, Naghavi Behzad M. Lecture-based Versus Problem-Based Learning Methods in Public Health Course for Medical Students. Res Dev Med Educ. 2012; 1(2): 31-5. doi: 10.5681/rdme.2012.008.
19. Kocaman G, Dicle A, Ugur A. A longitudinal analysis of the self-directed learning readiness level of nursing students enrolled in a problem-based curriculum. J Nurs Educ. 2009 May;48(5):286-90. doi: 10.3928/01484834-20090416-09. [PMID: 19476035]
20. Chakravarthi S, Haleagrahara N. Implementation of PBL curriculum involving multiple disciplines in undergraduate medical education programme. International Education Studies. 2010; 3(1): 165-9. doi:10.5539/ies.v3n1p165.
21. Meo SA. Evaluating learning among undergraduate medical students in schools with traditional and problem-based curricula. Adv Physiol Educ. 2013 Sep;37(3):249-53. doi: 10.1152/advan.00031.2013. [PMID: 24022771]
22. Niwa M, Saiki T, Fujisaki K, Suzuki Y, Evans P. The Effects of Problem-Based-Learning on the Academic Achievements of Medical Students in One Japanese Medical School, Over a Twenty-Year Period. Health Professions Education. 2016; 2(1): 3-9. doi:10.1016/j.hpe.2016.01.003.
23. Marques PAO, Correia NCM. Nursing Education Based on "Hybrid" Problem-Based Learning: The Impact of PBL-Based Clinical Cases on a Pathophysiology Course. J Nurs Educ. 2017 Jan 1;56(1):60. doi: 10.3928/01484834-20161219-12. [PMID: 28118478]
24. Panjehpour M, Ataee N. Comparison the effectiveness of problem solving method with lecture-based method in the teaching of metabolic biochemistry. Iran J Med Educ. 2012; 11 (9):1318-25. [In Persian]
25. Peng WS, Wang L, Zhang H, Zhang Z, Wu YM, Sang X, et al. Application of virtual scenario simulation combined with problem-based learning for paediatric medical students. J Int Med Res. 2021 Feb;49(2):300060520979210. doi: 10.1177/0300060520979210. [PMID: 33554701] [PMCID: PMC7871091]
26. Hajibabaee F, Ashrafizadeh H. A Comprehensive Review of Problem-based Learning in the Iranian Nursing Education. Iran Journal of Nursing. 2019; 32(118): 12-30. doi: 10.29252/ijn.32.118.11. [In Persian]
27. Wood DF. Problem based learning. BMJ 01 Feb 2003; 326(7384):328-30. doi: 10.1136/bmj.326.7384.328. [PMID: 12574050] [PMCID: PMC1125189]