

Specifics of problem-based learning in the pharmaceutical education process

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ABSTRACT

Problem-based learning has gained great popularity among the world's top educational institutions since it is contributed to the development of students' professional skills. This article aimed to study the application of problem-based learning in pharmaceutical education and conduct a comparative analysis of its advantages as perceived by university students of the first and last years. In 2018, the authors conducted a study using mixed methods of a sociological survey (focus group discussions and anonymous questioning) among 423 students. As a result, they revealed the main advantages of problem-based learning associated with the use of real-life situations, which ensured the reliability of the material under the study, contributed to a better understanding of the topic and enabled the application of the knowledge acquired before. The authors also proved that students of the first and last years perceived the above-mentioned benefits in a different way. The study results can help to realize new educational approaches based on the student's needs.

Keywords: problem-based learning, pharmaceutical education, active teaching methods, educational technologies, student-centered approach

Introduction

Nowadays, problem-based learning (PBL) has gained popularity among the world's top educational institutions since it lays the basis for the integration of different educational technologies into the educational process. The problem-based activity has become the standard of professional activity, i.e. future employers want to see graduates as specialists focused on solving complex tasks and capable of making the best decision.^[1, 2] The educational systems of all countries in the world are in search of new models,

approaches, and concepts and the complexity of the constructive problems of the present determines the educational attitudes and priorities.^[3] Education is considered a main field of focus, which creates and promotes knowledge and skill and improves human resource attitude and performance.^[4] In this regard, the modern paradigm of education has aimed to acquire a wide range of competencies whose development can be achieved through PBL.^[5-8] Human resources constitute the foundation of health systems. If the plans and projects related to training of human resources are not compatible with the health and social conditions of a country it will not be able to raise people's health to a level where they can economically and socially have productive lives.^[9] According to the requirements of the federal state educational standard of higher education in the specialty "Pharmacy", a graduate must form both universal and professional competencies while mastering the program. The first universal competence mentioned in the federal standard has been the development of systematic and critical thinking, i.e. the ability to critically analyze problem situations based on the

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systemic approach and develop a proper action strategy. One of the main didactic tools of PBL that is widely used in teaching students of all ages is the case-study method presented as a number of case problems. Unlike practical calculation tasks, case problems do not have a standard solution or a ready-made answer, which allows students to reflect using their own knowledge. Students analyze a specific situation, determine the strengths and weaknesses, suggest possible ways to solve it and discuss them in a group. While solving case problems that cover some situations and aims at finding the best possible solution, students intensify their mental activity, develop creativity and creative thinking and adapt to different situations.^[10-12] Throughout the development of professional skills, a significant role is played by students' motivation to learn. Motivation is the reason for doing many activities such as learning.^[13] One of the advantages of PBL is an increase in the students' motivation and interest in the educational process based on the use of real-life situations as examples.^[14-16] In addition, the solution of case problems encourages the active independent activity of the students in contrast to the traditional methods.^[17-19] Many scholars have noted the better students' performance, critical thinking, and acquired knowledge due to PBL.^[18, 20-22] Thus, the present educational trend was conducted to improve the students' performance using new educational technologies, including PBL.^[6, 10, 23-26]

The article aimed to study the application of PBL in pharmaceutical education and conduct a comparative analysis of its advantages as perceived by university students of the first and last years.

Materials and Methods

The study was conducted in the Department of Organization and Economics of Pharmacy at the Institute of Pharmacy of Sechenov University in 2018. The authors used qualitative and quantitative methods of a sociological survey (focus group discussions and anonymous questioning). Regarding the relevance of the research topic, the authors developed a questionnaire that included closed-end questions, alternative questions (with only one answer to choose by the respondent) and non-alternative questions (a choice of several answers was offered) to assess the students' perception of PBL methods used in the department and find ways to improve the educational process. To make sure that students fully understood the topic under the study, the authors included a question with a verbal gradation based on a Likert-type scale into the questionnaire. The students of the first year (236 people out of 278, which accounted for 85%) and the fifth year (187 people out of 225, which accounted for 83.1%) in the specialty "Pharmacy" took part in the study. Throughout the survey, the authors managed to ensure a high level of confidentiality and anonymity. The results of focus group discussions were processed using thematic analysis, while the survey data were considered with the help of variation-based descriptive statistics. The authors analyzed the importance of PBL for the students using a relative level of significance

calculated as the ratio of the total assessment of a specific issue to the maximum assessment of the most significant issue.

Results

Nowadays, different technologies are used to prepare highly qualified pharmacists, including PBL that lets students increase their mental activity, use and improve their knowledge. One of the main didactic tools of PBL is a case problem that helps to acquire the necessary professional competence. In this examination, the authors studied the real and desired use of PBL methods. Using the five-point scale, the students were asked to evaluate how much they use case problems and problem-based lectures in the educational process and to what extent they wanted to use them (0 points – never use/would rather not use, 5 points – use as much as possible/would like to use). It has been revealed that the students of the last years actively used case problems (4.24 points). Moreover, they were interested in such methods and wanted to utilize them even more in their study materials (4.56 points). Freshmen who had just enrolled at universities evaluated the frequency of solving case problems during their classes at 3.09 points but they also wanted to use this method more often (4.30 points). The above-mentioned results indicated the high interest of the students in PBL and the effectiveness of this method for optimizing the educational process. Problem-based lectures (the teacher created a case problem and asked students to find its solution) were used less frequently (2.32 points – fifth-year students; 1.81 points – first-year students). However, both last-year (3.60 points) and first-year students would like to have more of such lectures in their curriculum (3.88 points). It gives additional opportunities to upgrade the existing curriculum in accordance with students' preferences. While studying at the Faculty of Pharmacy, students also use some elements of PBL in the context of term papers and research projects. The teacher poses a problem for the students and thoroughly examines them during the learning process. The students substantiate the relevance of the topic given, set the objectives and tasks, conduct scientific research, and draw certain conclusions.

While processing the issue in question according to the verbal gradation of a Likert-type scale (from "absolutely unknown" to "absolutely known"), the authors observed that the concept of "PBL" is known for more than half of the first-year (54.2%) and last-year students (63.1%) enrolled at the Department of Pharmacy. At the same time, the students of different course years did not provide different responses. Many of them acknowledged they had difficulties in understanding this definition (about one-third of students of both groups chose the answers "mostly unknown" and "mostly known"). Although methods of PBL were used in different disciplines, no attention was paid to the fact that these methods are not problem-based themselves. The authors considered this fact while forming a questionnaire. To determine the main advantages of PBL, students were provided with its definition.

Indeed, PBL is a highly effective method in the educational process, which has been confirmed by many scholars. The

authors took a particular interest in determining its advantages for the students. The authors considered the following factors as decisive (Table 1).

Table 1: The advantages of PBL as perceived by the first- and last-year students

Advantages of PBL	Students' answers					Relative significance level
	The 1 st year		The last year		Average	
	%	People	%	People		
Real-life situations to guarantee the authenticity of learning materials	61.0	144	58.3	109	59.8	1.000
Ensures a better understanding of the topic under study	65.7	150	48.7	91	57.0	0.953
Gives an opportunity to use the knowledge acquired	60.6	143	35.8	67	55.3	0.925
Co-education is more effective	38.1	90	28.9	54	34.0	0.569
Improves communication skills	55.9	132	56.7	106	56.3	0.941
Ensures equal education	16.9	40	10.2	19	13.9	0.232
Improves life skills	57.2	137	40.7	76	50.4	0.843
Improves life-long learning	34.7	82	24.6	46	30.3	0.507
Enables a competitive analysis of fellow students	24.6	58	12.3	23	19.1	0.319

According to more than half of all the students, real-life situations ensured the reliability of the material under the study, which, in turn, helped the future specialists to quickly adapt to various professional fields (59.8%). Since this characteristic was recognized as the most important for calculating the relative coefficient of significance, it was chosen as the basic unit. Within the framework of focus-group discussions with graduates, it was revealed that one of the main problems of employment is the insufficient preparation of candidates for real working conditions. The use of PBL along with practical exercises based on the so-called training pharmacy can help students faster adapt to the work process. It should be noted that teachers refer to real-life situations to prepare case problems, which also contributes to the optimization of the educational process and the synchronization of knowledge gained with modern market conditions and requirements. Although the average realism of life situations ensuring the reliability of learning materials was prioritized, the most important advantage for first-year students was the fact that PBL contributed to a better understanding of the topic (65.7%). On the contrary, this characteristic came in the third for fifth-year students (48.7%). This suggested that the most important component in the learning process for first-year students was the process of mastering materials and conducting the subsequent evaluation that confirmed the quality of the material adopted. However, the key component for the fifth-year students was the reliability of the material under the study (58.3%) and the improved communication skills (56.7%). Communication skills defined by the standard as the ability to use modern communication technologies for academic and professional interaction were among the universal competences that are required to master during the study of any given curriculum. Although communication was ranked second by the last-year students and fifth by freshmen, it was determined that it was generally important for both groups of students (the level of relative importance was 0.941), since skills of the competent

communication are necessary for any field of activity. In the conditions of a modern developing society and pharmaceutical market, the use of communication skills plays a significant role in improving the efficiency of the working process, which is especially important for senior managers who communicate daily with partners, suppliers, and subordinates as a part of their work responsibilities. The third most important component for the first-year students was the possibility of using previously acquired knowledge for solving problems. It was explained by their desire to ascertain the need for acquired knowledge in the context of future activities to prove and assert themselves in a team by demonstrating their intelligence.

The authors have established that such an advantage of PBL as the improvement of life skills was important for half of the students surveyed, which indicated the key role of higher education in the development of an individual as not only a highly qualified specialist but also a person as a whole. At the same time, it was almost one and a half times more significant for the first-year students (57.2%) than the fifth-year students (40.7%) since the life skills of the latter were more developed in contrast to the first group who only began to form the skills necessary for the independent living. Since the solution of case problems involved a group discussion, the effectiveness of co-education was an important advantage for 38.1% of first-year students and for 29.8% of fifth-year students, which indicated greater independence and personal development of the latter. More than a third of the first-year students and a quarter of the fifth-year students believed that PBL utilized real-life situations and provided an incentive to improve life-long learning (34.7% and 24.6%, respectively). Notably, the federal state educational standard also included "the ability to determine and implement the priorities of one's activities and ways to improve them based on self-assessment and life-long education" into the universal competences. According to the above-mentioned facts, lifelong learning skills are regarded as a crucial advantage of PBL.

Discussions of the problem posed by the teacher in a group revealed knowledge gaps and provided opportunities to fill them. Some students named the possibility of competitive peer assessment as an important factor, which was almost two times more important for the freshmen (24.6% and 12.3%, respectively). Assessment (provided by both teachers and fellow students) was among the methods of self-affirmation in a team used by first-year students. The research demonstrated that almost half of freshmen consider assessment an important part of the educational process, which encourages students to learn and motivates them to get good marks. In addition to involvement in the educational process through the development of professional interest, PBL motivated students to learn indirectly, i.e. through others' assessments. One more advantage that was of greater importance for first-year students was the possibility of an equal education (16.9% and 10.2%, respectively). While answering this question in the questionnaire provided, the students could choose several options: the first-year students selected more options than the fifth-year ones. On the one hand, this fact may indicate bigger enthusiasm and inspiration of the first-year students associated with the beginning of a new stage in life, like studying at a higher educational institution. On the other hand, it showed greater confidence in the fifth-year students in their answers and their well-formed personality.

Discussion

PBL in higher education is a systemic foundation for combining pedagogical capabilities of various teaching methods.^[1] British scholars have studied the results of introducing a new approach to PBL in the field of pharmacy and linked the success of the new course with the encouragement of self-learning, feedback, and interest of students to the new format. They have also noted the improved basic skills of the medical staff.^[27] The faculty members of Kazakh universities introduced some elements of PBL into the educational process of future pharmacists within the framework of the competency-based approach to increase the students' motivation, develop professional thinking, and improve the quality of education.^[6]

PBL as an educational strategy has become quite common in educational institutions. In this regard, many studies have analyzed the use of this educational technology and its impact on improving the learning results. Thus, Hincapié and his colleagues considered the consequences of pedagogical intervention with the use of PBL. The statistical comparison of a group of medical students studying through PBL with a control group has demonstrated that this strategy increased the motivation and critical thinking, and also had a positive effect on the academic performance.^[20] Scientists from Turkey compared the results of teaching chemistry using PBL and traditional methods. Based on the results obtained, they concluded that the average success in the experimental group (PBL) was significantly higher than that in the control (traditional methods) group.^[24] These results support the studies conducted in India that revealed a significant improvement in students' performance in the discipline of pathology after conducting problem-based sessions. It has been

well-known that PBL used real-life problems to better adopt knowledge and encourage student-centered learning.^[16] This research confirmed the importance of case problems in the educational process that are based on real-life situations that future specialists can encounter in their professional activities. According to the students who took part in the survey, it is the main advantage of PBL, which allows not only to study theoretical materials but also to use this knowledge for solving various professional problems. In 2018, Fan and his colleagues reviewed the literature on the use and study of PBL from 1993 to 2017. They emphasized that PBL aimed to develop lifelong skills to solve practical problems rather than limit one's learning to theoretical knowledge. To achieve the best results, it is necessary to constantly improve the educational process through timely feedback and evaluation.^[25]

In addition to studying the specific results of PBL and its impact on students' performance, an important aspect was the study of the students' perception of these learning methods. Scientists from Saudi Arabia conducted a survey of medical students regarding the benefits, preferences, and effectiveness of PBL. These scholars revealed an overall positive perception of all advantages of this approach, and the students also praised the effectiveness of PBL in acquiring knowledge and soft skills.^[28] Alduraywish and fellow scientists studied the experience of medical students with PBL through a qualitative survey. The results showed their general satisfaction with the course and improved general skills. In general, the students were positive about the implementation of PBL methods, but some of them noted heavy workload, which certainly corresponded to the traditional education.^[15] Engku also noted that the students liked the PBL approach and, based on the study results, highlighted the following positive aspects of PBL: promotion of the educational process, independent learning, teamwork, deeper learning, and applicability to real-life situations. However, there were also some problems associated with the significant time costs, the unwillingness of some classmates to cooperate and change the evaluation methods (Engku 2018). The data obtained throughout this research was generally consistent with the studies described above. At the same time, the authors provided a more detailed quantitative description and revealed differences in the way the university students of the first and last years perceived the positive aspects of PBL. Further research can study the results of the effective implementation of this method, as well as the problems experienced by the students during the transition from traditional education to PBL.

Conclusion

The objective need for new educational technologies that can prepare highly qualified specialists ready for modern working conditions was determined by the market changes expanding the range of medicines and medical devices, as well as competition among the pharmaceutical organizations. The authors proved that the educational process based on the students' needs should be accompanied by a comprehensive curriculum including PBL methods and other active methods to motivate students to learn

and reveal their creative potential. One of the directions of PBL is the case-study method, which develops the ability to critically analyze case problems based on the systemic approach and provide an action strategy in accordance with the requirements of the federal state educational standard. PBL utilizes real-life situations, which ensures the reliability of the knowledge gained and prepares future specialists for various aspects of professional activity while improving the students' life and communication skills. Thus, the study results can help introduce new educational approaches based on the students' needs.

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References

- Ibragimov G.I. Problem training in system of the higher education: state and tendencies of development. *Bulletin of the Buryat state university. Education. Personality. Society* 2016; 1: 17-26.
- Losseva I.V., Medeshova A.T. Training Pharmacists in Ksmu In Accordance with The Requirements of Modern Pharmaceutical Market. *International Research Journal* 2015; 2(33): 20-21.
- Saltanati, A. Zhando, A. Dusembinova, A. Galiya, S. & Aigul, M. Preparation of Future Teachers for Primary Schools to Develop the Schoolchildren's Health Culture. *Örgütsel Davranış Araştırmaları Dergisi Journal of Organizational Behavior Research*. 2019; 4 (1): 33-42.
- Dahmarde, H. Khodabakhshi, M. & Mahmoodi Rad, Gh. Birjand teaching hospital nurses' attitudes towards personal development plan. *Pharmacophore*, 2018; 9(3): 25-29.
- Krikova A.V., Krukova N.O., Pavlyuchenkova N.A. Study Success Analysis in Pharmaceutical Management and Economics. *Smolensk medical almanac* 2015; 2: 73-75.
- Arystanova T.A., Arystanov Zh.M., Shukirbekova A.B., Akhelova Sh.L. Interactive methods of education and control of knowledge in pharmaceutical education, *Vestnik KazNMU* 2013; 5(3): 4-6.
- Grishin A.V. Actual directions of improving Russian higher pharmaceutical education *Bulletin of Siberian Medicine*. Omsk 2006, 2: 85-88.
- Mekovec R., Aničić K.P., Arbanas K. Developing Undergraduate IT Students' Generic Competencies Through Problem-Based Learning, *TEM Journal* 2018; 7(1): 193-200.
- Dehghani, H. & Nasiriani, Kh. Cardiac Care Unit Nurses' Perception of Educational Competencies (Modified Delphi Method). *International Journal of Pharmaceutical and Phytopharmacological Research*, 2017;7(3):1-8.
- Glusker A. Motivational Design and Problem-Based Learning May Increase Student Engagement in Information Literacy Instruction Sessions. *Evidence Based Library and Information Practice*, 2017; 12(4): 259-261.
- Reddy P. Research methods for undergraduate delivery: evaluation of problem-based learning. *Perspectives in Education* 2018; 36: 44-62.
- Engku H., Engku I. Problem-based Learning (PBL) in Sociolinguistics as a Way of Encouraging Active Learning. *MATEC Web of Conferences* 2018; 150: 05075.
- Nasiri Ziba, F. Bozorgvar, A. Hannani, S. & Haqqani, H. Achievement Motivation and Its Relationship with some Demographic Factors among OR Students at IUMS in 2017. *International Journal of Pharmaceutical and Phytopharmacological Research*, 2018; 8(6):72-80.
- Bazrafcan L., Takmil F., Shokrpour N. Assessing the Effectiveness of Problem-Based Learning as a New Approach on Health Care Provider Ethical Reasoning Development in Shiraz University of Medical Sciences. *Health Care Manag (Frederick)*. 2018; 37(3): 273-277.
- Alduraywish A.A., Mohager M.O., Alenezi M.J., Nail A.M., Aljafari A.S. Evaluation of students' experience with Problem-based Learning (PBL) applied at the College of Medicine, Al-Jouf University, Saudi Arabia. *J Pak Med Assoc*. 2017; 67(12): 1870-1873.
- Preeti B.A, Ashish A.B., Shriram G.C. Teaching undergraduates through "problem based learning" a better approach *Journal of Clinical and Diagnostic Research* 2013; 7(12): 2896-2897.
- Litvinova T.M., Glazkova I.Y., Kolomiets O.M., Smyslova O.A., Denisova M.N. Using case method in organizing student academic/professional activity as part of the educational process. *Espacios* 2017; 38(56): 29.
- Liu L., Du X., Zhang Z., Zhou J. Effect of problem-based learning in pharmacology education: A meta-analysis. *Studies in Educational Evaluation* 2019; 60: 43-58.
- Ma Y., Lu X. The effectiveness of problem-based learning in pediatric medical education in China: A meta-analysis of randomized controlled trials. *Medicine (Baltimore)* 2019; 98(2): e14052.
- Hincapié Parra D.A., Ramos Monobe A., Chrino-Barceló V. Problem-based learning as an active learning strategy and its impact on academic performance and critical thinking of medical students. *Revista Complutense de Educacion* 2018; 29(3): 665-681.
- Hussain M., Sahudin S., Abu Samah N.H., Anuar N.K. Students perception of an industry based approach problem based learning (PBL) and their performance in drug delivery courses. *Saudi Pharm J*. 2019; 27(2): 274-282.
- Pu D., Ni J., Song D. Influence of critical thinking disposition on the learning efficiency of problem-based learning in undergraduate medical students, *BMC Med Educ* 2019; 19: 1.

23. Litvinova T.M., Kasimovskaya N.A., Petrova V.N., Kochetkov I.G., Kostina Y.A. The internal system for quality assessment of education results at a medical university. *Electronic Journal of General Medicine* 2018; 15(4).
24. Ayyildiz Y., Tarhan L. Problem-based learning in teaching chemistry: enthalpy changes in systems. *Research in Science & Technological Education*, 2018; 36(1): 35-54.
25. Fan C., Jiang B., Shi X., Wang E., Li Q. Update on research and application of problem-based learning in medical science education. *Biochem Mol Biol Educ*. 2018; 46(2): 186-194.
26. Magnussen R., Senounou F.M., Hilmy S. Potentials and barriers for implementation of learning technologies to support problem-based learning inspired methods in higher education in Jordan. *European Conference on E-Learning* 2018; 347-353.
27. Strohfeldt K, Khutoryanskaya O. Using Problem-Based Learning in a Chemistry Practical Class for Pharmacy Students and Engaging Them with Feedback. *Am J Pharm Educ*. 2015; 25; 79(9): 141.
28. Ibrahim M.E., Al-Shahrani A.M., Abdalla M.E., Abubaker I.M., Mohamed, M.E. The Effectiveness of Problem-based Learning in Acquisition of Knowledge, Soft Skills During Basic and Preclinical Sciences: Medical Students' Points of View. *Acta Inform Med*. 2018; 26(2): 119-124.