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APPLICATION OF PROBLEM-BASED LEARNING AS A UNIVERSAL MEANS OF TRAINING MODERN SPECIALISTS

Abstract. The article considers the application of the problem-based learning method as a universal means of training modern specialists in various fields. The relevance of the study is explained by the existence of a social order in modern society for a specialist – a harmoniously developed, creative personality, able to think logically, find solutions in various problem situations, systematize and accumulate knowledge, capable of adequate self-analysis, self-development and self-correction, as well as open to dialogue and able to work in a team. The use of problem-based learning in higher education allows you to educate just such a specialist, forms critical thinking, and the ability to quickly make decisions and adapt to complex situations. The purpose of the article is to substantiate the need to use problem-based learning technology in higher education institutions to increase the effectiveness of training modern specialists and demonstrate specific problem cases for future doctors, pharmacists, IT specialists, and specialists in extreme and crisis psychology. Research methods: the study used partially exploratory and descriptive methods; to select material for problem cases, the master's degree programs «Pharmacy», «Cybersecurity» and «Crisis Psychology» have been analyzed. Specific cases have been presented for applicants studying in the IT field, pharmacy, extreme and crisis psychology specialties, indicating the research, methods, and results of the research. The problem-based learning methodology not only helps students acquire the necessary knowledge, skills, and abilities but also promotes their intellectual development, forms the ability to independently master new information through creative activity, increases interest in the learning process, and ensures high-quality learning outcomes.

Keywords: problem-based learning, problem situation, problem case, IT sphere, pharmacy, extreme and crisis psychology.

Introduction. At the present stage of human development, a social order for a specialist has taken root in society – a harmoniously developed, creative personality, able to think logically, find solutions in various problem situations, systematize and accumulate knowledge, capable of adequate self-analysis, self-development and self-correction, as well as open to dialogue and able to work in a team. The use of problem-based learning in universities allows us to educate just such a specialist.

Analysis of recent research and publications. Problem-based learning technology has a long tradition and dates back to the Socratic method – the use of open-ended questions to stimulate thinking, the creation of cognitive conflict when the learner realizes that his knowledge is incomplete or contradictory, and the gradual approach to the correct conclusion through dialogue.

The basis for the application of the method at the present stage was the work of John Dewey, one of the founders of the concept of «learning by doing». It was Dewey in «Experience and Education» who argued that learning should be based on real-life situations that cause cognitive conflict and stimulate students to active thinking, and introduced the concept of «problem situation» as the main factor in the development of critical thinking [1].

A special contribution to the development of the theory of problem-based («heuristic learning») learning was made by Jerome Bruner, who substantiated the concept of open learning in «The Process of Education», which is the basis of problem-based learning, and argued that knowledge should not simply be transferred in a ready-made form, but should be discovered through active search and research [2].

A.Gebos and L.Szekely studied the effectiveness of problem-based learning in the context of developing cognitive skills and creative thinking and proved that problem-based learning contributes to faster learning of complex material and the formation of the ability to work with uncertainty [3].

The issue of problem-based learning was not ignored in Soviet pedagogy. O.Matiushkin substantiated the concept of «problem situation» and developed the structure of problem-based learning and methods for creating problem situations. I.Lerner classified the types of problem-based learning according to the level of student activity, studied problem-based learning as a means of developing creative thinking. M.Makhmutov suggested methods of problem-based learning depending on the level of student readiness and argued that problem-based learning provides intellectual development through

the mechanism of independent search for knowledge [4].

S.Vitvytska studied the role of problem-based learning in teacher training, analyzed the effectiveness of the problem-based approach in the formation of pedagogical skills [5]. M.Fitsula researched the relationship between problem-based learning and students' independent thinking [6].

The high effectiveness of problem-based learning is noted in the works of modern domestic psychologists and teachers. Apologists for the use of problems to motivate and activate educational activities are O.Hulai [7], and S.Snisar [8]. O.Ivanchenko and O.Melnikova (medical and biological physics) talk about problem-based learning in certain fields [9], the issue of using problem-based learning in the training of doctors is highlighted by K.Linevych and O.Shevchenko [10], O.Voloshyna (pedagogical cycle) [11].

In general, modern researchers discuss the impact of problem-based learning on student motivation, the formation of creative and projective skills in students, and the use of a problem-based approach in a digital educational environment.

The purpose of the article is to substantiate the need to apply problem-based learning technology in higher education institutions to increase the effectiveness of training modern specialists and demonstrate specific problem cases for future doctors, pharmacists, IT specialists, and specialists in extreme and crisis psychology.

Research methods. During the study, partial search and descriptive methods were used; to select material for problem cases, the master's educational programs «Pharmacy», «Cybersecurity» and «Crisis Psychology» have been analyzed.

Results and Discussion. Problem-based learning is a method in which students are confronted with a real or simulated problem situation that needs to be investigated and solved. The main idea is that problem-solving is the driving force of cognition.

Our goal is to demonstrate that the problem-based learning method is universal and can be used in the training of future specialists for various industries. Wherever analytical thinking, research skills, and the ability to make decisions (sometimes quick, and sometimes balanced and responsible) are required, where the ability to work in a team is necessary, it is worth using problem-based learning as a method of obtaining new knowledge.

In the context of rapid technological development and changing labor market requirements for IT specialists, the higher education system must respond by appropriately updating the content component of professional training for future software engineers, searching for new organizational forms of training and cooperation with IT companies, which requires the development of new approaches and teaching methods in universities. Problem-based learning in IT specialties is a key approach since programming, software development, cybersecurity, and data analysis involve solving real problems and the ability to adapt to changing conditions [12].

Below are the main goals of problem-based learning in IT.

Development of algorithmic thinking – IT specialists learn not just to write code but to analyze problems and find optimal solutions. Development of practical skills – learning occurs through practical application of theory, not passive memorization. Formation of the ability to work in conditions of uncertainty – in real IT projects, there are always «blank spots», so it is important to be able to independently search for solutions. Development of teamwork skills – problem-based learning is often implemented through group projects and hackathons that simulate work in an IT team. Formation of the ability to self-educate – the IT industry is changing rapidly, so specialists must be able to search for information, test hypotheses, and adapt to new technologies.

Problem-based learning in pharmacy and medicine is used to develop practical skills, clinical thinking, and decision-making skills in real professional situations. Since pharmacists work with medicines, interact with patients, doctors, and drug manufacturers, they need to not only know the theoretical material but also be able to analyze, predict risks, and find the best solutions in complex circumstances [13].

The main goals of problem-based learning in pharmacy and medicine are:

1. Development of clinical and analytical thinking. Problem-based learning helps students learn to evaluate medicines interactions, their side effects, and possible risks.

2. Formation of evidence-based medicine skills. Pharmacists must be able to navigate clinical trials, analyze information, and distinguish scientifically based treatment methods from pseudoscience.

3. Development of the ability to solve real professional tasks. Students learn to make optimal decisions in situations where there are several treatment options.

4. Formation of communication skills. Future pharmacists and doctors must be able to communicate with patients and colleagues, explain the rules for taking medications.

5. Preparation for real pharmacy or medical practice. Problem-based learning brings the educational process closer to real situations in a pharmacy or hospital.

6. Learning under the circumstances of uncertainty. Pharmacists and physicians often have to make decisions with incomplete information or work with unique clinical cases.

Problem situations in the course of extreme and crisis psychology should model real or close to real events in which students need to analyze the situation, predict behavioral reactions, make decisions, and provide psychological assistance. Specialists in this area should not only have theoretical knowledge but also be ready to make decisions quickly, adapt to unforeseen circumstances, and effectively interact with people experiencing a crisis [14].

The main goals of problem-based learning in crisis psychology are:

1. Development of crisis thinking and rapid response skills. A psychologist in crises often operates under limited time and information, so it is important to learn how to assess the situation and make quick decisions, determine the level of psychological trauma and the threat to a person, and use effective methods of crisis assistance.

2. Formation of skills of psychological stabilization and crisis intervention. Psychologists must be able to quickly stabilize a person's condition to avoid aggravation of their stress reaction.

3. Development of communication skills in crises.

4. Training in working with different types of crises.

5. Training in stress resistance and emotional self-regulation. Psychologists working in crises is to remain calm and not succumb to emotional burnout.

In general, the structure of problem-based learning can be presented as follows (Figure 1):

Organization of the educational process, during which students gain knowledge as a result of analytical work on solving problems and problem situations, tasks that are built on the material being studied	+	Organization of active independent problem-solving activities of students	=	Creative mastery of knowledge, skills, abilities and development of their mental abilities

Figure 1. Structure of problem-based learning

The conditions for organizing effective independent work in higher medical education institutions were studied by O.Isaieva and G.Shainer. The researchers emphasized the importance of ensuring interdisciplinary connections during independent work and orienting tasks towards resolving problem situations related to real life and production cases [15, p.47].

The development of problem-based learning technology is quite complex and requires a teacher to have high pedagogical skills, as well as a lot of time for preparation. The use of the didactic system of problem-based learning in a higher educational institution is «a creative, emotionally rich work of teachers and students, which requires purposefulness, great willpower, and high responsibility. It ensures a solid assimilation of knowledge, makes educational activities exciting, as it teaches to think and overcome difficulties» [15, p. 47].

In addition, the teacher must create comfortable conditions in which each student realizes his intellectual abilities and feels successful. This is ensured by various types of activities, such as discussions, problem lectures, business games, and work on projects [8, p.71].

Usually, an educational problem is considered as an intellectual complication that arises due to difficulties in formulating a substantiated characteristic of a certain process, object or phenomenon. It requires the search for new approaches and methods to achieve educational goals and solve the tasks set.

Problem situations that the teacher offers in lectures and practical classes should be very carefully thought out. When faced with a problem, students must distinguish between the known and the unknown, clearly know what exactly they need to learn, and also be able to outline ways to resolve contradictions [9, p.66].

In modern pedagogical literature, the following requirements for educational problem situations are called:

– The problem should stimulate candidates to seek a deeper understanding of concepts or theories.

– The problem should require applicants to make informed decisions and defend them.

– The problem should contain such tasks that to solve them, candidates need to connect it with previous courses/knowledge.

– If the problem is being solved in groups, it should be of such a level of complexity which stimulates all applicants to unite to achieve the goal.

– If the problem involves a multi-step solution, the initial steps should be interesting and open-ended to motivate students to explore [16].

Finally, the problem is to have a solution, and we fully agree with Confucius: «It is very difficult to look for a black cat in a dark room, especially when it is not there.»

S.Vazhynskyi and T.Shcherbak list 5 types of problem situations [17, p.88]. O.Shynkaruk and O.Didenko believe that there are 7 of those:

– A conflict situation arises when there are contradictions: a) between a possible theoretical way of solving a problem based on the knowledge of education seekers and the impossibility of their practical use; b) between the practically obtained result (known fact) and the lack of only subject knowledge for its theoretical justification.

– A situation of surprise is created when higher education students are introduced to phenomena, conclusions, and facts that surprise, captivate with their unusualness, and are considered paradoxical.

– A situation of assumption is created when the existence of a theory, law, or phenomenon does not correlate with previously obtained knowledge, or it is necessary to prove the validity of any assumption. In such circumstances, an assumption is made about the possibility of the existence of a new pattern or phenomenon, and students are involved in a research search.

– A situation of denial or refutation is created when students are asked to prove the falsity of an assumption, idea, conclusion, or project.

– A situation of inconsistency arises in cases where the concepts and ideas that have spontaneously formed among students, as well as their life experience, come into conflict with scientific data.

– Choice situation is created in the cases when it is suggested to choose the correct approach to solving a problem from several possible and known ones and justify your choice.

– A situation of uncertainty is created when students are offered tasks with insufficient or excessive data to obtain a clear answer [18, p.32].

Using the above classification, we have developed several problem cases for doctors, pharmacists, IT professionals, and crisis psychologists.

Nowadays, the method of attracting employees by «growing» them independently is very popular. Some IT giants, in particular, Epam and SoftServe, are taking this path. Each of these companies has its separate division that is engaged in training new personnel for relevant positions.

The process is as follows: people without experience come to the company and undergo an intensive training course in a certain specialization. After completing the course, they take an exam and get access to perform real tasks within the framework of a training project.

While working on the project, interns are to demonstrate their readiness to complete tasks quickly and efficiently. These projects are reviewed by experienced employees of the company, who assess whether the candidate is ready to become a part of the team.

Sample problem cases for pharmacists, doctors, IT professionals, and crisis psychologists are provided in Tables 1, 2, 3, 4.

Problem cases for doctors help students learn to comprehensively assess a patient's condition, correctly adjust therapy, and effectively communicate with patients of all ages.

Problem situations in the course of extreme and crisis psychology should model real or near-real events in which students need to analyze the situation, predict behavioral reactions, make decisions, and provide psychological assistance.

Table 1

Sample problem cases for pharmacists

Problem	Question	Purpose
The problem of non-adherence to medication regimen: the client voluntarily stopped treatment and contacted the pharmacy with complaints of a significant deterioration in his health.	How to motivate the patient to adhere to the course of treatment and explain the consequences of self-termination of therapy?	It develops: communication and persuasion skills, ability to work with patients who violate treatment regimen.
The problem of drug incompatibility: A regular pharmacy customer buys three types of medicines at once: an anticoagulant, a nonsteroidal anti-inflammatory, and a herbal sedative. He does not inform the doctor about the entire list. The pharmacist notices the risks of compatibility.	How to delicately explain the danger to the patient and advise him or her to see a doctor?	It develops: the ability to identify dangerous drug interactions, the ability to communicate tactfully and professionally with patients, helps to understand the role of the pharmacist in the healthcare system.

Table 2

Sample problem cases for doctors

Problem	Question	Purpose
The «patient with three diagnoses» problem: Olena, 62, came to the doctor complaining of headache and fatigue. Her medical history includes hypertension, type 2 diabetes, and osteoarthritis. She takes five different medications on her own. She has been getting worse in recent weeks..	What could have caused the condition to worsen? What should the doctor do?	It develops the skills: 1. Integrated approach to treatment – the assment of the relationship between multiple chronic diseases. 2. Pharmacological literacy – analysis of polypharmacy (simultaneous administration of several drugs) and possible interactions between them. 3. Differential diagnosis – the ability to determine whether new symptoms are caused by disease progression, side effects of medications, or their interactions. 4. Patient communication – how to explain the importance of medication adherence, lifestyle changes, and regular health monitoring. 5. Multidisciplinary approach – interaction of the doctor with a pharmacist, endocrinologist, cardiologist and rheumatologist to optimize treatment.
The problem of «the surgery that the family fears»: A 12-year-old boy needs emergency surgery for appendicitis. His mother is categorically against surgery due to family beliefs. His father supports the doctors but doesn't want conflict.	How should a doctor act ethically and communicatively?	It develops the skills: 1. Medical ethics and legal aspects – understanding when doctors can make decisions without parental consent, especially in cases that threaten the child's life. 2. Communication and work with relatives – how to convince the mother, explain the risks of refusing surgery, support the father and help him defend the child's interests. 3. Crisis management – the ability to act quickly and effectively in situations where decisions need to be made immediately. 4. Psychological flexibility – working with relatives' emotions, fears, and religious or cultural beliefs. 5. Interdisciplinary interaction – coordination of actions between doctors, hospital lawyers and social services to make the right decision.

Table 3

Sample problem cases for IT professionals

Problem	Question	Purpose
Leak of confidential data of a large company. A hacker attack exposes a database containing the personal information of thousands of customers, causing widespread discontent, a decline in the company's reputation, and possible legal consequences.	How to identify the source of the leak and stop it? What measures should be taken to protect customer personal data? How to communicate with victims and reduce reputational damage to the company?	It develops: skills in dealing with information security incidents, communication skills, and crisis PR.
Malware on the university network. Students and faculty at the university are reporting computer crashes, file deletions, and access to educational resources being blocked. Preliminary analysis indicates that the system has been infected with malware that is spreading over a local network.	How to identify the source of infection and prevent further spread of the virus? What tools should be used to restore the system? How to educate users to avoid similar threats in the future?	It develops: practical skills in malware analysis, system recovery, and user awareness.

Web application crashes because of memory leak. A financial company uses a web application on ASP.NET Core, and customers start complaining about the slow performance of the service. Logging shows frequent OutOfMemoryExceptions, which cause the application to crash.	How to find the source of a memory leak in a .NET application code? What tools can be used for memory profiling and diagnostics? How to prevent similar problems in the future?	It develops: skills in debugging and optimizing the performance of .NET applications, working with monitoring tools (e.g., dotMemory, PerfView, GC Logs).

Table 4

Sample problem cases for crisis psychologists

Problem	Question	Purpose
Environmental disaster: Due to a leak of toxic chemicals at a factory, the city's residents are evacuated. Panic, fear, aggression are observed in the temporary camp, and some people fall into a stupor.	How should a psychologist act in the first hours after a disaster? What crisis intervention methods should be used for adults and children? How to help those who are in a state of acute stress or apathy?	It develops: the ability to work with victims under stress, to use stabilization techniques.
Military conflict and PTSD: A soldier has returned from war. He complains of nightmares, restless sleep, aggressive reactions to loud noises, and avoids talking about combat.	How to recognize post-traumatic stress disorder (PTSD)? What psychotherapy methods are most effective for working with veterans? How to help his family cope with the situation?	It develops: knowledge about PTSD, skills in psychological support for veterans and their families.
Terrorist attack in a public place: there's an explosion in the subway. As a crisis psychologist, you arrive at the scene with rescuers. Some people are in shock, some are screaming, and others are frozen.	How to organize the provision of psychological first aid? What stabilization techniques should be used for different reactions (panic, stupor, aggression)? How to work with those who have lost loved ones?	It develops: crisis communication, psychological first aid (PFA) skills, and management of emotional reactions.
Suicidal crisis in a teenager: a 15-year-old boy has posted on social media about his plans to commit suicide. His friends have told his parents, but they believe it is just «teenage pranks.»	How to determine the level of suicidal risk? What actions should be taken immediately? How to talk to a teenager and his or her family?	It develops: understanding of suicidal behavior, crisis counseling, prevention methods.

Conclusions. Problem-based learning is an educational method that uses real-world, challenging tasks as a learning tool. This approach encourages students to apply critical thinking and problem-solving skills in a timed manner, which promotes hands-on experience and active learning. The problem-based learning methodology not only helps students acquire the necessary knowledge, skills, and abilities, but also promotes their intellectual development, forms the ability to independently master new information through creative activity, increases interest in the learning process, and ensures high-quality learning outcomes.

Конфлікт інтересів. Автори підтверджують відсутність фінансових, особистих чи інших інтересів, що можуть розглядатися як потенційний конфлікт інтересів щодо публікації цієї статті.
Фінансування. Робота виконана за відсутності фінансової підтримки з боку будь-яких організацій.
Доступність даних. Це теоретичне дослідження не передбачає використання додаткових наборів даних.
Використання штучного інтелекту. Інструменти штучного інтелекту не використовувались при написанні цієї роботи.

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ЗАСТОСУВАННЯ ПРОБЛЕМНОГО НАВЧАННЯ ЯК УНІВЕРСАЛЬНОГО ЗАСОБУ ПІДГОТОВКИ СУЧАСНИХ СПЕЦІАЛІСТІВ

Анотація. У статті розглядається застосування методу проблемного навчання як універсального засобу підготовки сучасних фахівців різних галузей. Актуальність дослідження пояснюється існуванням соціального замовлення у сучасному суспільстві на спеціаліста – гармонійно розвинену, творчу особистість, здатну логічно мислити, знаходити рішення в різних проблемних ситуаціях, систематизувати й накопичувати знання, здатну до адекватного самоаналізу, саморозвитку й самокорекції, а також відкриту до діалогу й спроможну працювати в колективі. Застосування проблемного навчання у вишах дозволяє виховати саме такого фахівця, формує критичне мислення, вміння швидко ухвалювати рішення та адаптуватися до складних ситуацій. Метою статті є обґрунтування необхідності застосування технології проблемного навчання у вищих закладах освіти для підвищення ефективності підготовки сучасних фахівців та демонстрація конкретних проблемних кейсів для майбутніх лікарів, фармацевтів, фахівців ІТ-сфери та спеціалістів з екстремальної та кризової психології. Методи дослідження: під час дослідження використані частково-пошуковий та описовий методи, для відбору матеріалу проблемних кейсів проаналізовані магістерські освітні програми «Фармація», «Кібербезпека» та «Екстремальна та кризова психологія». Наведено конкретні проблемні кейси для здобувачів, які навчаються за спеціальностями ІТ-сфера, фармація, екстремальна та кризова психологія із зазначенням дослідження, методи та результати дослідження. Зроблено висновки, що застосування проблемного навчання спонукає здобувачів освіти використовувати критичне мислення, сприяє отриманню практичного досвіду та активному засвоєнню знань. Проблемне навчання є не тільки універсальним способом здобуття необхідних знань, умінь й навичок, а й сприяє інтелектуальному розвитку, формує здатність самостійно опановувати нову інформацію через творчу діяльність, підвищує інтерес до навчального процесу та забезпечує якісні результати навчання.

Ключові слова: проблемне навчання, проблемна ситуація, проблемний кейс, ІТ-сфера, фармація, екстремальна та кризова психологія.