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Strategies for developing critical thinking and problem-based learning in the modern educational environment

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Abstract Ensuring the development of critical thinking stands as an essential factor in shaping students' professional and educational growth, fostering improved learning quality, better assimilation of educational material, and the application of knowledge in practical settings. Within the research framework, a significant focus lies on formulating strategies for nurturing critical thinking. In the realm of pedagogical activities, this necessitates preparing, planning, and adapting strategies in line with the specific requirements of the educational audience. The primary objective of this academic paper is to explore current strategies, particularly those widely employed in advanced countries, aimed at enhancing students' cognitive and analytical capacities. An integral part of this exploration involves analyzing the utilization of the problem-based learning method as a catalyst for achieving heightened levels of critical thinking and analytical agility. This scientific article delineates the core theoretical components of the critical thinking concept, revealing diverse approaches to critical thinking strategies. Furthermore, it offers recommendations on integrating these strategies into the educational process, aligning them with established pedagogical methodologies. The investigation encompasses an examination of the practices in developed countries that stimulate critical thinking and the means employed to achieve this objective. The research findings underscore the imperative nature of fostering students' critical thinking within the educational environment, especially considering the escalating demand for technological advancements. Drawing upon a theoretical exploration of contemporary scholars and practical accomplishments of educational institutions, this academic paper aims to ensure and enhance the quality of critical thinking. Consequently, these findings serve as a foundational resource for devising future strategies, illustrating effective methods for cultivating students' cognitive capabilities.

Keywords: critical thinking, problem-based learning method, pedagogical activity, cognitive abilities, cognitive activity, logical interconnections.

1. Introduction

The modern development of education is carried out at a rapid pace, posing problems for the educational environment regarding the effectiveness of the formation of students' critical thinking skills. Critical thinking strategies can vary depending on the pedagogical activity and approaches to their formation, and the search for a solution to this issue is the task of modern scholars. The key principles of using critical thinking can be one's own educational activity and professional activity in the future, which is a priority for a person's life. Strategies for developing critical thinking are aimed at achieving pedagogical goals and the possibility of disseminating practice, improving them in accordance with the current needs of the educational market. The problem-based learning approach emphasizes the use of motivation as a technique for achieving academic success. The possibility of applying the acquired knowledge to solve a specific problem that may be of interest to students is a key catalyst for motivation to acquire knowledge. Under such circumstances, an effective strategy for developing critical thinking and improving the quality of the educational process requires the organization of pedagogical activities, namely, the formation of a curriculum of individual tasks, involvement of students in specific modern important projects, work on mistakes and improvement of the experience gained. The availability of information and group project enthusiasm are key factors for the

problem-based learning approach. Therefore, it is essential to develop motivation projects that will be helpful for both learning and putting them into practice for each teacher of a broad spectrum of disciplines. The academic paper focuses on the features of modern strategies for developing critical thinking and the qualitative aspects of their implementation. Theoretical and practical approaches to achieving the formation of critical thinking and prospects for their further development are still debatable.

The purpose of the research is to reveal the current aspects of forming strategies for developing critical thinking and to outline further prospects for their development based on the practice of the educational environment of advanced countries. The primary objectives of the research are theoretical analysis of the critical thinking concept, analysis of critical thinking strategies and the problem-based learning method, formation of results on aspects of their application and forecasting of prospects for further development. The academic paper analyzes the aspects of technological advantages of developed countries, qualitative and quantitative features of these advantages and the role of training qualified personnel in technological global competition. The scientific article focuses on enhancing the quality of critical thinking in the context of improving teachers' pedagogical qualifications and the basic directions of applying digital technologies as a tool for strengthening and advancing students' cognitive abilities.

2. Literature review

The issue of the strategy for developing critical thinking is an important debatable issue in the modern scientific community since the training of future generations is an essential factor in human activity. Scientists investigate the issue of effective strategies for critical thinking based on theoretical and experimental studies and on the practical results of implementing variable means. According to Andania (2021), critical thinking is the ability to use one's own cognitive tools to solve practical problems, which is formed as a result of perceiving a particular object. Benedicto (2022) partially agrees with this idea; the scholar notes that a key characteristic of critical thinking is the ability to analyze information, sort, and draw the relevant conclusions. The scientist Bahatheg (2019) emphasizes that critical thinking in the context of modern digital development is the most essential skill for students. After all, the ability to apply critical thinking will have a positive impact on the further scientific or professional activities of the pupil and the student. The scholars Udovychenko (2022) and Skliar (2021) consider it critical to strengthen the modern educational environment through the use of effective strategies, digital technologies and modernization of educational training and pedagogical activities. The theoretical approach to strategies for developing critical thinking was formulated by Chikiwa (2018); the researcher determines that the majority of strategies are aimed at the variability of the analysis performed by the student, which is interpreted as the ability to analyze information, logical, spatial, social and emotional analysis. According to applied studies by Dewi P. (2019), the implementation of pedagogical practices aimed at shaping critical thinking based on stimulating the solution of relevant tasks has positive results.

However, the primary issue, according to Solnyshkina (2022), is the sufficient content of students' motivation and the reflection of the subsequent result and the emotional component that will reflect the result of critical thinking activities. Under such conditions, the scholar Indriani (2017) argues that the method of problem-based learning can be an effective modern tool for developing critical thinking, which in real-life conditions offers to apply critical thinking to solve a particular problem. According to studies conducted by the scientist Kakar (2022), the use of the problem-based learning method is the most effective way to develop cognitive activity, critical thinking, and interest in the result. In the opinion of the scientist Miterianifa (2021), pedagogical activity is the main factor for improving the quality of implementing the problem-based learning method, which should focus on searching for existing problems to engage students, further analyzing current work, adjusting it, and forecasting. The author Zhang (2022) believes that pedagogical activities in modern educational conditions can be carried out through the use of information technologies, which can be an aspect of additional improvement of critical thinking. Based on the analysis of theoretical and practical studies on strategies for developing critical thinking, scientists are looking for the most effective methods and tools for transforming the modern educational environment to ensure learning development.

3. Materials and methods

The study on strategies for developing critical thinking was conducted on the basis of theoretical and analytical materials on potential means of its improvement and implementation. In particular, the paper has analyzed scientific materials and highlighted scientists' views on the practice of educational activities for stimulating critical thinking. The experience of European countries, the leaders of technological development in China, has been analyzed based on statistical information on the practice of graduating students and their ability to create socially useful ideas and relevant projects.

The research methodology in the academic paper is conducted sequentially. In the first stage, the essence of the concept of critical thinking and the main variational approaches to its application are analyzed. The following stage describes the most widely used methods for cultivating critical thinking, which have been systematized based on theoretical materials and sources. They describe the features of applying differentiated strategies and the best methods for their implementation, which are common among students of different ages. The analyzed strategies are grouped, the characteristic features of each of them are revealed, and a number of methods in pedagogical activities that can be used to activate students' critical thinking are

proposed. The theoretical content of the problem-based learning approach as well as its fundamental components has been examined at the following stage on the basis of scientific research techniques. The analytical method is applied to analyze the experience of an American educational institution that used this method to stimulate the improvement of existing knowledge and consolidate the real result.

Based on the analysis and disclosure of its characteristics, the major structural elements of this method and the practice of using this method in the United States, China and European countries are explained. The academic paper analyzes the current experience of countries on the policy of implementing and popularizing the use of this method. The final stage of the research was the characterization of the features of developing digital technologies and their impact on the ability to perceive and analyze information in accordance with the task set regarding the development of critical thinking. The implementation of this methodology made it possible to conduct the research and obtain the relevant results.

4. Results

Modern education is rapidly evolving due to global technological transformation and cultural evolution. A significant number of educational institutions place a high focus on the necessity of enhancing such a component of educational activities as critical thinking. Critical thinking makes it possible to quickly perceive information in the conditions of the global information world, apply analytical thinking and use the experience gained in practice. The use of critical thinking tools creates effective prerequisites for further learning activities and can provide subsequent career growth. Providing sufficient attention to critical thinking is strategically important to ensure that future professionals are able to work with current digital technologies and a large flow of information (Akimov et al., 2021).

The strategy for developing critical thinking, by its very nature, is a rational pedagogical activity aimed at encouraging students to perform certain tasks and the ability to conduct classes that can ensure the development of such critical thinking. The key principles of critical thinking should be independence, the ability to analyze information, search for it, the availability of one's own reasoned position and its further application. The introduction of an effective methodology to further ensure the formation of students' critical thinking is a priority for most universities due to the rapid development of technology and innovation. The primary strategies commonly used to develop critical thinking are outlined in Table 1.

Table 1 Strategies for developing critical thinking and methods of their implementation.

Strategy	Features	Methods of implementation
The ability to analyze the problem	It is the ability to determine the essence of the problem and key aspects for its solution.	The strategy is implemented by solving practical logical tasks.
Comparative analysis	This strategy involves the ability to use comparative analysis between objects to compare existing characteristics and draw logical conclusions, find similarities and differences, and be able to point out advantages and disadvantages.	The strategy can be used when performing comparative analysis tasks on specific practical objects: works, countries, decisions, etc.
Interpretations	It is the ability to analyze connotations, allegories and phrases in the form of metaphors or related activities that can stimulate analytical skills.	Performance of independent work on the interpretation of the main messages of the composition. Activation of reading and writing reviews and reflections on the main idea-concept of the composition.
Critics of the sources of information	The ability to analyze sources of information, their origin and the main content they convey. The ability to identify the position of the source and perceive it as an opinion.	To conduct a critical review of scientific sources, highlighting the main ideas of the author, to compare and analyze the reliability of these sources.
Search and evaluation of solutions	An active methodology that consists in the ability to find solutions and carry out such activities in accordance with the solution of a specific practical or logical problem.	The problem has multiple solutions or is a global issue that calls for sophisticated strategies. The best way to implement this strategy is to use group projects.
Self-assessment and reflection	The ability to analyze actions and identify advantages and disadvantages, draw up a plan for improvement and implement it in accordance with the existing goals.	The strategy can be implemented through the use of the "Work on mistakes" task or motivation to analyze one's own successes or failures and express opinions on further improvement.

Source: compiled by the authors.

The critical thinking strategies represented in Table 1 characterize the main methods aimed at ensuring students' ability to perform logical operations and analytical actions. The best way is to solve analytical and mathematical problems in primary school. However, according to numerous studies, reading and the ability to analyze information and draw appropriate conclusions are equally effective. This is precisely why, based on the formation and use of such strategies for developing critical thinking, it is possible to improve the current practice of achieving relevant results in the context of rapid digital transformation

(Dudnik et al., 2020). In addition, critical thinking can be ensured by strengthening the role of the educational environment in the direction of digitalization and the introduction of new automation systems and, as a result, modern scientific disciplines.

During 2019-2023, after the coronavirus pandemic spread, the practice of providing online education and efficient management gained popularity worldwide. Students should be able to master digital literacy abilities and use a number of various digital tools to accomplish their own learning goals to create the best learning environments. The teacher's ability to independently use such tools and direct them to the appropriate task is equally important. The strengthening of the strategy of using problem-based learning and critical thinking as the primary instructional strategy may be a qualitative feature (Akimova et al., 2022).

The problem-based learning method is an innovative tool. It is aimed at two key factors: the first is the implementation of one's own skills and tasks in solving a real existing problem; the second has a high concentration of the motivating element created by the prospect of seeing the outcome and the expectation of it. The problem-based learning approach is one of the key strategies for fostering critical thinking in the contemporary educational environment on the basis of these two elements. Let us examine the problem-based learning approach and the key components of its structure in more detail in Figure 1.
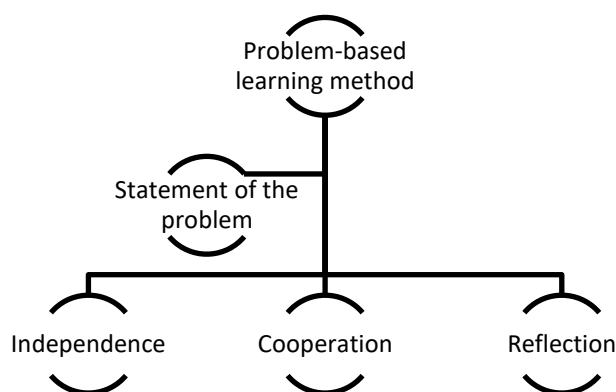

Figure 1 Structural elements of problem-based learning methods
Source: compiled by the authors.

The elements depicted in Figure 1 characterize and structure problem-based learning methods to the greatest extent. The problem-based learning method is an innovative tool that aims to stimulate students' cognitive and analytical problem-solving abilities through the lens of real-world problems. The use of this approach has many advantages, including the following: real practice of educational activities, motivational aspects, display of results, and students' increased interest. For instance, the most common example of the problem-based learning method was implemented in an elementary school in the United States, namely, Westgate Elementary School. The students were offered to support the website on the basis of a real problem – solving environmental issues on a local scale. Students were given a real-world case for internships during the biology classes using the illustration of plant care materials. The results of this experiment were positive, which led to a significant improvement in the quality of learning and the desire to learn new material and use it in practice. Following this example, problem-based learning is used in most educational institutions practicing this methodology as an effective basis for conducting educational activities and consolidating the knowledge gained.

Considering the method of problem-based learning, it is worth reviewing each of its structural elements and the impact on students' ability to learn to improve their own skills and abilities, both cognitive and social, communication, which is a significant aspect in the implementation of professional activities. The development and completion of numerous individual homework assignments or group projects with a focus on solving particular difficulties constitutes real practice in studying the material. In the context of modern educational development, it should be borne in mind that an effective method of implementing such a practice would be using specific global issues and searching for ways to solve them. This can be an attempt to solve a cultural issue, do math, create a group project, or carry out any socially useful activity that can provide real results. Holding educational competitions targeted at solving certain challenges should be a good way to encourage learning activities focused on the actual application of knowledge. The psychological aspect of introducing competitions and contests is actively used in the European Union, where there are a number of competitions for any academic discipline that motivate solving the problems of a particular subject (Shytyk, 2020).

The implementation of the problem-based learning method is based on the possibility of working out real-life problems that can be conditionally divided into cultural, social, economic, environmental and any other issues. To reach the goals established, it is essential to analyze the current issues and what can be offered to students to consolidate their knowledge. This project offers a chance to enhance learning abilities. The experience of China in developing students' abilities and critical thinking through the use of this method is a striking example (Zayed, 2022). As of 2023, China is one of the three leaders in technological development, which is driven by the availability of technology parks and specially created business incubators.

However, the state strategy for human capital development, which involves the introduction of problem-based learning methods, is equally important. This method is implemented in the following way: a number of projects are organized for students and pupils, in which students can join and receive real rewards in the form of investments, participation in thematic competitions of the project, etc. According to statistics, approximately 10% of Chinese school graduates have experience running and creating a number of startups and projects. The introduction of this experience in Ukraine or in the European Union can stimulate the improvement of education and increase the motivation to obtain education.

Increasing interest and stimulating critical thinking can be achieved through pedagogical practices and the application of up-to-date learning technologies. The problem-based method can be implemented as a means of developing digital skills and critical thinking for both students and teachers. There is a wide range of digital solutions and technologies that can improve the quality of learning, facilitate pedagogical activities and enhance students' educational activities. In such circumstances, the appropriate use of digital technologies will be of key importance for students who are willing to improve their professional skills and ensure further positive career development. Scientists believe that critical thinking can be developed through the use and solution of logical problems and mastering a foreign language. The practice of learning any foreign language has a positive effect on the quality of critical thinking and provides access to a wider range of information. Therefore, using a foreign language as a tool for further education is a successful way to enhance the level of critical thinking and students' learning ability. A vast majority of higher educational institutions follow this principle, and a number of student exchange programs are available there. The development of such programs makes it possible to increase the ability to perceive a new cultural environment and provides access to increased critical analytical thinking (Lytvyn et al., 2022).

Taking into account the outlined aspects regarding the strategy for developing critical thinking and problem-based learning in the modern educational environment, it can be concluded that the primary principles of improving critical thinking are solving logical problems, mastering a foreign language, stimulating independent problem solving and increasing cognitive activity. Cognitive abilities in the modern educational environment can be formed through the use of up-to-date digital technologies, specialized platforms where the educational process is conducted. In addition, the application of problem-based learning, following the example of advanced countries such as China or the United States, will ensure effective education and solve the problem of the shortage of specialized personnel in the long run. The formation of critical thinking is based on the effective use of strategies and the possibility of their extension to any other area of a student's life, which is becoming a priority for the modern educational environment.

5. Discussion

The conducted research testifies to the need for the development of critical thinking in the modern educational environment, which is driven by the rapid development of digital technologies and the increase in the amount of available information. According to Kalive (2021), modern techniques based on the application of the problem-based learning approach and practices that encourage the solution of specific problems are needed for the optimal development of a critical thinking strategy. The most important finding of the research is that the approach can be highly effective if it is feasible to see how critical thinking and scientific activity interact. Modern scientists are exploring the most relevant methods for the further development and improvement of critical thinking, which can be used to strengthen the role of the educational component in the context of global digital transformation.

The performed theoretical analysis shows the diversity of views on the issues of the strategy of developing critical thinking. The key factor in the distinction and differentiation of these strategies lies in the methods of achieving them. According to the theoretical standpoint Khudhair (2019), the implementation of these strategies takes place when conducting effective pedagogical activities and creating relevant conditions for strengthening the motivational component of students. A different standpoint is held by the Chinese educational environment, which uses problem-based learning and information technologies as key tools to enhance critical thinking and ability. Conducting further studies on the features of cultural approaches to the education system and analyzing the available results, searching for individual indicators of the quality of critical thinking and further life of graduates of educational institutions remains a debatable issue. According to the analytical data of the research, innovations and technological development can become indicators of the quality of critical thinking and the success of educational institutions. However, the principles of its improvement and approaches to its formation require additional studies.

The development of state support for educational institutions and the implementation of a strategy for assisting teachers in developing their skills and conducting educational training should all be essential areas for future analytical investigations. According to Kaeppel (2021), the modern practice of spreading digital technologies and using them in the educational process can stimulate the improvement and development of critical thinking in the educational environment among students. Following this approach, correlation and regression analysis of the level of using digital technologies and the degree of developing critical thinking can become an important area for analysis. In addition, such studies can use a variety of strategies for developing critical thinking, including the method of problem-based learning.

6. Conclusions

Based on the research results, a number of conclusions can be drawn regarding strategies for developing critical thinking and using the problem-based learning method. The essence of the concept of critical thinking is the ability to use a number of characteristics of cognitive abilities to analyze an object, draw one's own conclusions and form logical connections. The strategy for developing critical thinking is the ability of the teacher to stimulate the development of these skills among students. The most common strategies of critical thinking are the ability to analyze a problem, comparative analysis, reflection, interpretation and criticism of available sources of information. The application of these strategies can enhance the motivational factor, help support spatial representation, and improve the search for logical connections and a series of associative series that can be used in the student's academic, vocational or everyday activities. Based on the analysis conducted, the academic paper concludes that a unique and very successful technique of problem-based learning is gaining popularity as a critical thinking development strategy in the context of contemporary technological advancement.

The main objective of this method is to involve students in the actual resolution of local issues, with social-economic issues being the most beneficial kind to focus on. The implementation of this method has a number of advantages, including as follows: the ability to apply one's own knowledge in practice, the formation of a powerful motivational component, the stimulation of cognitive activity, and the development of analytical skills. The digitalization of learning and the use of a variety of innovative technologies stimulate the search for innovative solutions that enhance their role in the learning process. This is precisely why, according to this practice, the strategy for developing critical thinking is created through the integration of modern technologies in the educational process. The experience of developed countries, in particular, the United States and China, shows that the application of this method is actively carried out through the pedagogical activities of teachers and the presence of various institutions that form the following issues that can be addressed by educational institutions. The implementation of this experience will have a positive effect on the further development and formation of the country's human capital as well as strengthen the level of digital skills.

Ethical considerations

Not applicable.

Conflict of Interest

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