

Development of critical thinking skills in schoolchildren through project activities

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Abstract. This article analyzes the challenges and prospects of cultivating critical thinking skills in students through project-oriented tasks. It explores essential concepts and strategies related to critical thinking and project-based learning within the framework of educational institutions. Through an evaluation of the extent to which project-based activities are utilized in schools, the need for developing critical thinking is highlighted. The article also discusses the practical application of a program aimed at enhancing critical thinking skills in tenth-grade students through project-based activities on the basis of individual profile subjects allowed to increase the level of critical thinking in students of the experimental group. The improvement of critical thinking indicators according to the methodology of Y.F. Gushchin and N.V. Smirnov was noted. The findings from the modified L. Starkey test also show notable advancements in all areas of critical thinking, particularly in drawing logical conclusions and analyzing information. These results collectively support the idea that project-based activities positively influence the enhancement of critical thinking skills in students. General recommendations for more effective use of project activities in the educational process for the development of flexible skills have been developed.



Keywords: skills, critical thinking, project activity, schoolchildren, schoolchildren's development.



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Introduction

The modern education system in the conditions of constant transformations in society and the labor market is faced with the need to form critical thinking skills in schoolchildren. This skill plays a key role for successful adaptation in a rapidly changing world, as it allows a person to make informed decisions, effectively use resources, relate theory to practice and apply it in practice. This is due to the fact that in modern conditions

the school is faced with the task of preparing its students not just for adult life, but also for various kinds of changes in it. In today's world, it is crucial for individuals to cultivate flexible, dynamic, and constructive traits—qualities that cannot be attained merely by acquiring academic knowledge from the school curriculum. Today's youth must be capable of making informed decisions, optimizing available resources, connecting theory with real-world application, and developing various other competencies

essential for thriving in modern society. Based on this, the basic flexible skills include, first of all, creativity, autonomy, students' critical thinking ability and some others. In the context of globalization and accelerated progress based on the rapid development of educational and other technologies, fostering critical thinking as an independent skill is crucial for enabling students to effectively navigate the demands of contemporary society. A variety of strategies are used to nurture critical thinking, one of which involves according to many researchers [1] C. Cortazar [2] is the use of project activity in this process. Since project activity, as a method of teaching, gives students the opportunity to apply in practice, the knowledge obtained. Provided that they have the skills to analyze, search, find and make informed decisions and some others.

The study's significance is rooted in the need to identify new opportunities within the educational system that foster the development of students' character able to think critically and capable of conscious self-development and choice of their life direction. Such an opportunity appears to be project activity as a method of prospective learning, which is included in various aspects of the education process. As it allows developing flexible competences, which are important and necessary to ensure a more successful life activity.

The degree of research on the topic under consideration is considered to be high. It is necessary to note first of all foreign authors, which include the works of D. Halpern suggested that the definition of critical thinking should include cognitive strategies and skills that enhance the likelihood of achieving an effective outcome. These include project activity [3]. T. Isnani points out that it is not necessary to identify critical thinking with important thinking processes, as it is much broader than these processes and is subject to independent development [4]. V. Dubrovskii, Y. Gorbik, L. Pidzhoyan and others have contributed to the development of methodological support for project activities in different areas of knowledge,

including at the level of school education [5]. The concepts put forward by these authors have been integrated into contemporary understandings of project-based activities and their impact on fostering critical thinking in students.

Scholars in Kazakhstan are likewise deeply exploring how project-based learning activities contribute to the development of critical thinking skills in students. Notable contributions include the work of M.I. Karagozina, who examines various aspects of its development, which can be outlined as follows: critical thinking as a key method for understanding, analyzing, synthesizing, and evaluating information, serving as a foundation for action [6]. D.U. Kusainov investigates the development of critical thinking at the level of higher education and notes the connection of critical thinking with project activities [7]. N.T. Ospanova identified the main pedagogical conditions that show the effectiveness of critical thinking formation at the high school level [8]. It is also important to note the works of A.A. Tashetova and others [9].

However, several aspects remain underexplored. Specifically, there is a need for a more comprehensive investigation into the integration of project-based activities in fostering critical thinking in students. Moreover, new methods and approaches for organizing this process should also be taken into account.

The objective of this study is to analyze the impact of project-based activities on the development of critical thinking in students and to provide recommendations for improving the educational process.

Objectives of the study:

1. To explore the key concepts and principles linked to critical thinking and project-based activities within the framework of school education;
2. Evaluate the level of selected critical thinking indicators during project activities in school;

3. To determine the level of critical thinking in students;
4. Assess the impact of project-based activities on the development of critical thinking;
5. to develop recommendations for more effective use of project activities in the educational process.

The focus of the study is critical thinking skills in general education students. The subject of the study is project-based activity as a method for developing critical thinking skills.

The practical value lies in the recommendations developed, which can be utilized to enhance the school learning process and applied in future research.

Materials and Methods

The study utilized monographs, textbooks, academic articles, and other relevant materials, along with data gathered from student observations, testing, and the findings obtained throughout the research. A holistic approach was employed in the research, incorporating various methods to ensure a thorough investigation, with all methods focused on obtaining accurate data regarding the effect of project-based activities on enhancing critical thinking skills in students.

1. The goal of the literature review is to investigate current sources to examine the fundamental concepts and principles related to critical thinking and project-based activities in the context of school education.
2. Observation method based on the systematic collection of data about 10th grade students. The purpose of the observation was to obtain objective information about how students apply in practice the skills of project activities and critical thinking within the educational process.

3. The testing method was used to assess the level of critical thinking before and after participation in project activities. Two methods were used, including specialized questionnaires:

- methodology for determining the level of critical thinking (Y.F. Gushchin, N.V. Smirnov);
- L. Starkey's test to assess critical thinking (adapted into Russian by E.L. Lutsenko);

4. A mathematical-statistical method using Student's t-criterion for related samples to assess whether changes between two measurements before and after the experiment are statistically significant;

5. Methods of analytical analysis.

Results

Results of the literature analysis in the scope of the basic concepts and provisions on the topic of critical thinking and project activity at the school level of education.

Critical thinking is regarded as a comprehensive form of thought that challenges various aspects and serves as a rational, evaluative process in human cognition. In the context of school education, it is understood as the process of developing critical thinking techniques, which involves correlating a person's existing knowledge with external information, enabling them to make informed decisions about what should be accepted, what should be added, and what to let go or completely reject. Critical thinking teaches to correct one's own beliefs, to act actively and in many ways helps a person to understand how to use the information received [10].

The basic model of technology for the development of critical thinking at the level of school education includes three stages:

1. The challenge is designed to assess knowledge on the topic, stimulate interest in the subject of study, highlight gaps in the

field of knowledge, and encourage proactive engagement;

2. Comprehension of content is regarded as the active process of acquiring and understanding new information, relating it to existing knowledge, and observing the process of cognition and understanding;

3. Reflection is a process of holistic comprehension of the received information and creation of one's own attitude to the study material, as well as search for other topics and some problems for further work [11]. They reflect a unified process of progression of the teacher and his/her students regarding the achievement of the set goals to the learning outcomes of mastering each new subject topic and the whole course of study at school.

The main problems related to the development of critical thinking skills in schoolchildren that require detailed study are [12]: the study identifies several challenges, including the insufficient methodological support and limited educational resources on the topic, lack of time and resources for development, conservatism within the current educational system, low student motivation, social and cultural influences, issues with evaluating results, and the absence of interdisciplinary approaches, among others. [13] The development of critical thinking in schools is achieved through its integration across various academic subjects. While school curricula are usually built on the subject principle, which makes it difficult to use interdisciplinary approaches in this part.

Project activity at school [14] aims that schoolchildren, learning the ways of project activity and mastering them in practice, develop abilities that are useful in learning and will be needed in adult life. These skills encompass analyzing complex situations, setting objectives, planning strategies to achieve goals, assessing solutions, making well-informed decisions, identifying and resolving issues, working collaboratively in teams, and more.

The significance of fostering critical thinking in schools through project-based activities [15] lies in cultivating the ability to analyze, assess, and interpret information; to apply the acquired knowledge in practice; to work in a team. It also increases motivation for learning. Project-based learning allows students to develop basic key rigid and flexible competencies, primarily critical thinking [16].

The results of the observation method to determine the level of development of project activity and critical thinking in schoolchildren. The observation was conducted during half of the school year in two 10th grades of secondary school. Each class consisted of 28 students. The observation program included criteria for evaluating students' behavior and actions in project activities. The criteria included four main indicators:

- 1) activity in discussing and solving problems;
- 2) The ability to ask questions and hypothesize;
- 3) level of information analysis and reasoning;
- 4) autonomy in decision-making.

All observations were recorded in special protocols, which reflected the behavior of each pupil within the framework of all criteria. The students were also interviewed to assess their awareness of the results obtained. All collected data were analyzed and allowed to establish the dynamics of changes in the level of critical thinking of each student.

As shown in Figure 1, the overall results of observing the development of project activity and critical thinking skills in 10th-grade students are presented across four evaluation criteria.

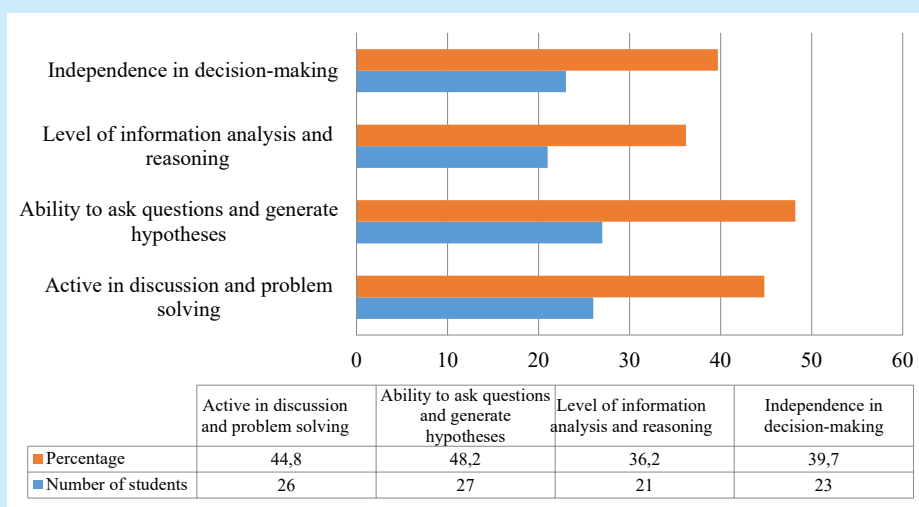


Figure 1 - Outcomes of critical thinking skill development in project activities among 10th-grade students (n=58).

The results indicate the need for the development of critical thinking.

A program for developing critical thinking through project activities was created and tested in lessons with the experimental class.

The purpose of the program: to develop students' critical thinking skills by actively involving them in project activities aimed at solving actual problems in the study of subjects: history of Kazakhstan and biology.

Stages of program implementation:

1. Introductory module (1 week) to discuss the importance of critical thinking in the study of history and biology in the form of a lecture-discussion. Main activities: introduction to the concept of critical thinking; introduction to the methods of scientific analysis and interpretation of the studied information; consideration of examples of the use of critical thinking in the history of Kazakhstan and biology.
2. Choosing a project topic (1 week) by subject from those proposed by the teacher. Main activities: group work to discuss possible topics; individual consultations with the teacher; defining the goals and objectives of the project.

3. Research phase (2 weeks). Main activities: search and selection of information; analysis of biological data and experiments; analysis of historical sources; consultations with teachers.

4. Project development (3 weeks). Forms: scientific report, presentation, multimedia project, laboratory experiment, etc. Key activities include developing the project structure, creating content (such as texts, tables, graphs, videos, photos, etc.), conducting laboratory experiments (when required), and testing the project to ensure it aligns with the goals and objectives.

5. Project presentation (1 week) is conducted in the format of an oral report, presentation, demonstration of multimedia material or mini-conference. Main activities: preparation of the presentation; public speaking; answering questions and discussion.

6. Summing up (1 week): students analyze their experience, evaluate successes and difficulties, and make plans for the future. Main activities: filling out feedback questionnaires; discussing achievements and difficulties; critical thinking tests.

Such active methods of critical thinking

development within the framework of project activities as discussions and debates; Socratic Questioning method; case analysis; role-playing games and simulations; Six Hats method; development of hypotheses and their testing; provocative questions and paradoxes; reflection and feedback and others were used.

The results of assessment of critical thinking level according to the methodology of Y.F. Gushchin and N.V. Smirnov. This methodology is used to assess in general the critical thinking of 10th grade students. The test consists of 15 tasks to which it is

necessary to give reasonable answers. Each task is evaluated in 3 points. The maximum score is 45 points: a person who scores 36 or more points has a high level; a person who scores between 15 and 36 points has a medium level; a person who scores up to 15 points has a low level.

The results obtained before the experiment are reflected according to Figure 2.

The experimental group demonstrates superior performance in comparison to the control group.

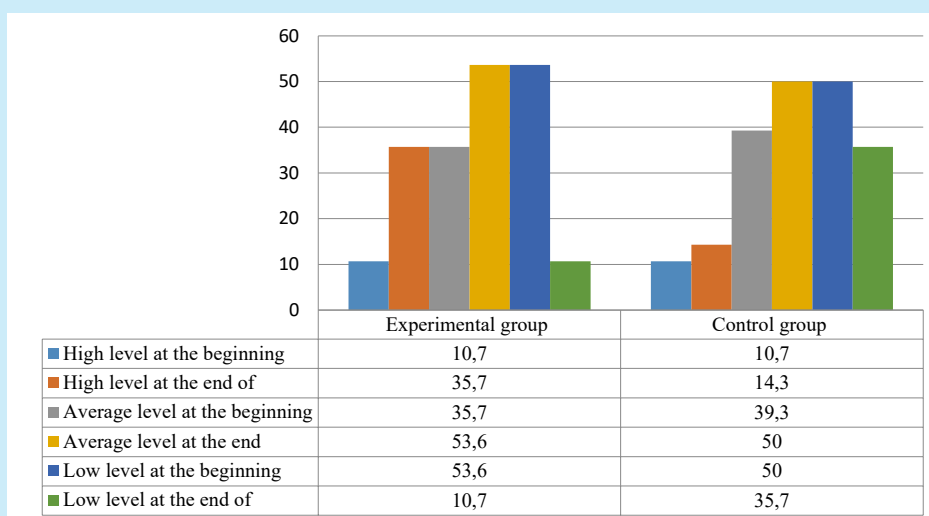


Figure 2 - Results of the comparative analysis of critical thinking level assessment based on the methodology of Y.F. Gushchin and N.V. Smirnov at the end of the period, presented as percentages.

The adapted L. Starkey test results are utilized to evaluate the critical thinking level of 10th-grade students. L. Starkey's test includes 27 questions, which can be grouped into several blocks. Each question has four answers. Each answer is evaluated in one point. The testing time is 25 minutes. The scoring scale is from 0 to 4 points. 0 points - low level or initial signs of critical thinking. 2 points - basic level of critical thinking. 3 points - medium or moderate level. 4 points - high level of critical thinking, excellent response that includes original

ideas and unconventional approaches.

The obtained results were grouped into seven most important critical skills, in the scope of which the statistical significance of changes was checked using Student's t-criterion.

The results are reflected in Table 1 in the extent of individual critical thinking indicators highlighted by Lauren Starkey's test in the form of seven key critical thinking skills.

Table 1. Results of the assessment of critical thinking level according to the adapted test of L. Starkey, in the average indicators by groups.

Indicators	Group	Average score at the beginning	Mean score after the experiment	Changes	Significant differences (ps)
General level of critical thinking	EG	18,84	25,63	+6,79	0,002
	KG	18,78	20,18	+1,4	0,005
In terms of observational skills	EG	1,54	1,69	+0.15	0,001
	KG	1,29	1,29	-0.12	-
On the ability to search for and select relevant information	EG	2,86	3,40	+0.54	0,005
	KG	2,96	3,04	+0.08	-
On the ability to distinguish fact from opinion	EG	1,71	1,75	+0.04	0,001
	KG	1,32	1,30	-0.02	-
By ability to identify problems	EG	1,83	2,60	+0,77	0,001
	KG	1,87	2,00	+0.13	-
On the ability to assess the validity of judgments and main arguments	EG	3,09	4,14	+1,5	0,001
	KG	2,71	3,07	+0.99	-
Inference skills	EG	3,63	4,54	+0.91	0,001
	KG	2,92	3,39		-
By ability to draw logical conclusions	EG	4,14	7,51	+3.37	0,001
	KG	5,71	6,09	+0.38	-

The experimental group showed the highest results, with the overall critical thinking level starting at 18.84 and rising to 25.63 after the experiment. In the control group, the level began at 18.78 and increased to 20.18 by the end.

Discussion

Drawing from the data presented in Table 1, the following conclusions can be drawn regarding the development of critical thinking skills and project activities among 10th-grade students:

1. Almost half of the students (44.8%) actively engage in discussions, showing an interest in collaborative problem-solving and interaction with their peers.
2. The highest percentage (48.2%) of students show the ability to ask

questions and formulate hypotheses. This indicates the development of critical thinking and curiosity, which is an important aspect of project activities.

3. The lowest percentage (36.2%) of students shows the level of analyzing information and reasoning. This may indicate the need for additional instruction and support in developing critical analysis and reasoning skills.
4. Self-determination in decision making is shown by 39.7% of students, which is a positive indicator, but also indicates that this aspect can be improved.

Overall, the findings show that 10th-grade students possess fundamental project work and critical thinking skills; however, there are areas, particularly in analyzing information and reasoning, that require additional development and assistance. These findings

indicate a need for actions to enhance these skills. Specifically, additional methods and training activities are necessary to strengthen critical thinking abilities.

The suggested block program, developed to integrate projects across three subjects using the identified active methods, seeks to promote critical thinking among project participants while making the work process more engaging, efficient, and productive. A comparative analysis of the assessment results of students' critical thinking levels, based on the methodology of Y.F. Gushchin and N.V. Smirnov, in both the experimental and control groups during the test and control experiments, reveals the following: Initially, in the experimental group, 10.7% of students were at a high level, 35.7% at a medium level, and 53.6% at a low level. Following the experiment, the percentage of students at the high level increased significantly to 35.7%, the medium level rose to 53.6%, and the low level decreased notably to 10.7%. These results suggest a successful development of critical thinking within the experimental group. In the control group, the initial distribution was similar: 10.7% at the high level, 39.3% at the medium level, and 50% at the low level. By the end, there was a slight increase in the high level to 14.3%, stability in the medium level at 50.0%, and a modest decrease in the low level to 35.7%. This may indicate that the control group did not receive sufficient support in fostering critical thinking.

Overall, the results of the modified L. Starkey test emphasize the importance of targeted teaching and support in promoting critical thinking in students through project-based work. The experimental group demonstrated more successful improvements compared to the control group, attributed to the implementation of new techniques and approaches in project-based learning.

The experimental group showed a significant improvement of 6.79 in the overall level of critical thinking. And the control group has a less noticeable improvement of 1.4. The results of the experimental group: significant improvement (+6.79). All indicators show positive dynamics. The most

noticeable growth is observed in such skills as the ability to make logical conclusions (+3.37), assessing the validity of judgments and arguments (+1.05), and identifying problems (+0.77). Almost all changes have high statistical significance, indicating reliable improvements.

At the same time, the control group shows a slight improvement in the overall level of critical thinking. Most of the studied indicators show either a slight increase or even a slight decrease (in the ability to observe and distinguish fact from opinion. Statistical significance of changes is absent almost everywhere, except for the general level of critical thinking.

Drawing from the data of the modified L. Starkey test and the outcomes of the comparative analysis, it can be concluded that the formative experiment led to a significant improvement in critical thinking within the experimental group, while no similar progress was seen in the control group. Overall, the results align in many aspects with the findings of other researchers. Notably, S.N. Fortygina and N.A. Kozlova [15], as well as S. Andini and R. Rusmini [16], have explored the development of critical thinking through project activities in younger students. Additionally, J. Buchman [17] has examined critical thinking as a key competency in project-based learning to the creative potential of project activities of schoolchildren described by N. Dagbaeva, M. Osipova [18], the role of project activity in the process of developing critical thinking skills in learning a foreign language was shown by L. Duiseyeva, S. Bazhenova [19], F. Sarwanto defined as a means of developing critical thinking of students individual project [20]. The analysis of various authors' works confirms both the problematic and urgency of the development of critical thinking skills in schoolchildren through project activities. However, the presented research has a complex character, since it is based on the use of several methods and is focused on high school students.

Recommendations on the optimization of the educational process for the development of critical thinking skills in schoolchildren

through project activities have been developed:

- 1) A more defined establishment of goals and objectives for project activities, as students need to understand what they should aim for;
- 2) Decompose the project structure into distinct stages, progressing from simple to complex, in order to continually enhance students' critical thinking skills;
- 3) Encourage active participation of students by giving them the initiative to choose research methods and project topics;
- 4) Providing school children with access to different types of information and to modern technology;
- 5) Organizing feedback, which allows students to evaluate their mistakes and successes;
- 6) Encourage teamwork as the foundation of school design;
- 7) Use only criterion-referenced outcome assessment.

As part of these general recommendations, it is also suggested that:

- To place greater emphasis on developing information analysis and argumentation skills, as this area was identified as the weakest among students;
- Incorporate more practical lessons centered around project activities to foster students' independence and critical thinking;
- use more active methods of critical thinking development within the framework of project activities: discussions and debates; Socratic Questioning; case analysis; role-playing and simulations; Six Hats method; hypothesis development and testing; provocative questions and paradoxes; reflection and feedback and others.

A distinctive feature of the study is the adaptation of L. Starkey's method, which is typically used for working with adolescents aged 15 and older. As part of the study, a

program was developed and implemented to foster critical thinking through project activities. The program focused on addressing real-world issues within school subjects, such as the history of Kazakhstan and biology, enhancing the practical relevance of the results.

Conclusion

Observation results show that students have some project work and critical thinking skills, but there are areas that need improvement to achieve better results.

The critical thinking development program through project activities is designed to address real-world issues in the study of Kazakhstan's history and biology. Participation in these projects enables students to gain a deeper understanding of the country's historical context, biological processes, and their effects on ecology and human life. It also helps students develop research skills, enhance their critical thinking abilities, and improve other competencies essential for project-based work.

The results of the comparative analysis of critical thinking development, based on the methods of Y.F. Gushchin and N.V. Smirnov, showed that the experimental group experienced a significant improvement in critical thinking scores compared to the control group. The increase in the percentage of students with a high level of critical thinking from 10.7% to 35.7% highlights the effectiveness of the activities and strategies implemented. Furthermore, the decrease in the percentage of students with low levels of critical thinking to 10.7% reinforces these positive outcomes. In contrast, the control group demonstrated only a modest increase in high scores, coupled with a notable rise in low-level critical thinking, suggesting that, without active interventions and methodological support, critical thinking development does not progress.

The results obtained on the adapted L. Starkey test indicate that the experimental group showed significant improvement in all aspects of critical thinking, especially in the area of logical conclusions and

information analysis. This indicates the effectiveness of the experiment. In contrast, the control group showed only small positive shifts without pronounced dynamics, with some skills deteriorating. The absence of significant differences confirms that the changes in the control group were not significant.

The proposed strategies aim to enhance the effectiveness of project activities in fostering the development of students' critical thinking skills.

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Жобалау қызметі арқылы оқушылардың сыни ойлау дағдыларын дамыту

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Аңдатпа. Бұл мақалада жобалау қызметі арқылы оқушылардың сыни ойлау дағдыларын дамытудың мәселелері мен перспективалары қарастырылады. Мектептегі білім беру деңгейінде сыни ойлау және жобалық қызмет тақырыбы бойынша негізгі ұғымдар мен ережелер кеңейтілді. Мектепте жобалық қызметті пайдалану деңгейін бағалау барысында сыни ойлауды дамыту қажеттілігі белгіленеді. Жеке бейіндік пәндер негізінде жобалау қызметі арқылы оныншы сынып оқушыларының сыни ойлау дағдыларын дамыту бағдарламасын практикалық іске асыру эксперименттік топ оқушыларының сыни ойлау деңгейін арттыруға мүмкіндік берді. Әдістеме бойынша сыни ойлау көрсеткіштерінің жақсарғаны атап өтілді Ю.Ф. Гущина және Н.В. Смирнова. Бейімделген Л. Старки сынағынан алынған нәтижелер сыни ойлаудың барлық аспектілерінің, әсіресе логикалық қорытындылар мен ақпаратты талдау саласындағы айтарлықтай жақсарғанын көрсетеді. Осы деректердің барлығы Жобалық іс-әрекеттің оқушылардың сыни ойлауының дамуына оң әсер ететіндігін растайды. Икемді дағдыларды дамыту үшін білім беру процесінде жобалық қызметті неғұрлым тиімді пайдалану бойынша жалпы ұсынымдар әзірленді.



Кілтті сөздер: дағдылар, сыни ойлау, жобалық қызмет, оқушылар, оқушылардың дамуы

Развитие навыков критического мышления у школьников через проектную деятельность

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Аннотация. В данной статье рассматриваются проблемы и перспективы развития навыков критического мышления у школьников через проектную деятельность. Расширены основные понятия и положения по теме критического мышления и проектной деятельности на уровне школьного образования. В ходе оценки уровня использования проектной деятельности в школе устанавливается необходимость развития критического мышления. Практическая реализация программы развития навыков критического мышления у десятиклассников через проектную деятельность на основе индивидуальных профильных предметов позволила повысить уровень критического мышления у учащихся экспериментальной группы. Отмечено улучшение показателей критического мышления по методике Ю.Ф. Гущина и Н.В. Смирнова. Результаты, полученные по адаптированному тесту Л. Старки, также свидетельствуют о значительном улучшении всех аспектов критического мышления, особенно в области логических выводов и анализа информации. Все эти данные подтверждают, что проектная деятельность оказывает положительное влияние на развитие критического мышления школьников. Разработаны общие рекомендации по более эффективному использованию проектной деятельности в образовательном процессе для развития гибких навыков.



Keywords: навыки, критическое мышление, проектная деятельность, школьники, развитие школьников

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